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The Cunarder "Lucania" completed a westward voyage on Oct. 26 in 5 d. 7 h. 28 m., beating her best previous record by 20 minutes, and making the fastest trip across the Atlantic ever recorded. She maintained an average speed of 21.81 knots, and her course was 2,779 knots in length.

A 38-ton bridge-girder was hauled through the streets of Troy, N. Y., lately, upon two four-wheeled trucks with 5-in. tires. The load made an indentation of about 1 in. in passing over granite paving, possibly without a concrete base, but passed over the whole length of a brick-paved street with a concrete base without making any marks. A similar test of brick street pavement was made in Philadelphia lately, in the transport of a 50-ton girder hauled on two two-wheeled trucks with 12-in. tires. This pavement also had a concrete foundation, but the wheels broke through the pavement and sank to the hubs. The difference was that in Troy the load per wheel was about 4.8 tons, and in the Philadelphia test it was 12½ tons per wheel; and while the load per inch of tire was about the same in both cases, or one ton, the greater concentrated load in the Philadelphia case did the mischief. The better record of the Troy pavement was not necessarily due to a better class of paving material, as the "Troy Observer" claims.

Kindling locomotive fires with oil is an innovation which has gained ground very rapidly, and is now in general use by a large number of roads. Under the old plan of kindling with wood the cost of kindling a fire amounted to 30 or 40 cts., and an hour or more was required. With the oil kindler a bed of coal can be fully ignited in eight minutes with an expenditure of a few cents. The Chicago, Rock Island & Pacific kindled 4,690 fires in locomotives in August with oil kindlers, at an average cost of 1.46 cts. each. In the same month the average cost of kindling with wood was 33 cts. each.

Kansas City proposes to adopt the plan of selling its municipal franchises to the highest bidder. The exclusive franchise of the Kansas City Gas, Light & Coke Co. was originally granted for 30 years and expires on Feb. 20, 1895. The company has offered to reduce its rates to $1.50 if the city will renew its franchise for another 30-year period; but the city wishes to see what results it can obtain by inviting competition, and an ordinance has been introduced directing the city comptroller to advertise for sealed proposals for the franchise. The proposals must state the maximum price to be charged to private consumers and to the city, and the percentage of gross receipts to be paid to the city.

The Brooklyn bridge cable cars are to be lighted by electricity, the current being furnished by an overhead wire from which it will be collected by an ordinary trolley. The contract for the equipment was awarded on Oct. 26 to the Electrical & Mechanical Engineering & Trading Co., of New York city. The contractor agrees to supply the entire equipment for the 60 cars, 10 16-c. p. lamps in each, with the line wire, machinery, etc., and to complete the work in 100 days for $18,135. The contractor further agrees that the maintenance of the system shall not cost more than $1,350 per annum. The advisability of supplementing the line wire by storage batteries on each car to furnish light in case of the interruption of the main current supply was canvassed, but it was decided to omit this complication. Lighting cars by electricity by current taken from an overhead wire has been practiced on a railway in England and a railway in Russia, to light cars while passing through certain tunnels. It has also been in use on some of the Chicago cable railways to light the cars when passing through the tunnels under the Chicago River, and has been commonly practiced on electric railways ever since their introduction.

The most serious railway accident of the week was a rear collision near Croydon, Pa., on the Pennsylvania R. R. A work train consisting of one car had stopped to take on about 40 men who were at work on the track, and this train was run into by an extra freight train which was following close behind. Two men were killed and several more or less injured in the wreck or by jumping from the car.——A head collision occurred Oct. 23 near Walker, Tex., on the Southern Pacific Ry. The telegraph operator at Walker forgot to display the signal to stop a westbound passenger train, which should have waited there for an eastbound stock train to pass, and as other stations were closed he could not call up any operator to stop the other train. Two men were killed and five injured. Some of the freight cars caught fire and were burned.

A burning trestle on the Macon & Northern R. R., near Godfrey, Ga., gave way under a freight train of 30 cars Oct. 27, and one man was killed.

The roundhouse of the Intercolonial Ry. at Riviere du Loup, Que., was burned Oct. 21, and eight locomotives were destroyed, including two new express engines. The loss is estimated at $200,000.

By the bursting of a steam pipe on the French cruiser "Arethuse" while the engines were being tested at Brest, Oct. 25, six men were killed and 20 were badly scalded.

Careless work in blasting on the Chicago drainage canal resulted in two accidents near Summit, Ill., Oct. 21, by which four men were injured. In each case, according to reports, the men had put down drill holes about 4 ft., and then put in a small charge of dynamite to expand the hole. After the discharge of the dynamite they started to pour in some powder for the purpose of blasting the rock, but the discharge of the dynamite had so heated the rock that it set off the powder as soon as it was placed in the hole.

The interlocking plant put in at Buffalo, N. Y., for the Delaware, Lackawanna & Western R. R. by the Auto-Pneumatic Railway Signal Co., of Rochester, N. Y. (Eng. News, Dec. 21, 1893), has been in continuous operation since Oct. 26, 1893, and Mr. Frank A. Seabert, Division Superintendent, states that it has not lost a single movement and has required no repairs. The movements it has made within the year exceed 150,000.

A system of underground electric railways, to cost $12,000,000, is being discussed in Chicago, and is projected to relieve the crowded condition of the streets in the business district. The scheme appears thus far to be nothing more than desultory talk; and in view of the miry clay which underlies down-town Chicago, and which is already heavily loaded by the numerous skyscrapers, no such enterprise is likely to receive serious consideration.

The topographic and geologic map of the United States, now being prepared for issue in a folio atlas, 18×22 ins., is the most extensive and important publication of this kind ever undertaken by the government. These maps will show the topography and economic geology of the country, and will be accompanied by explanatory text. The topographic maps will show the relief of the surface by contours, distribution of water and drainage areas and the roads, railways, boundaries, villages and cities. The complete atlas will comprise several thousand folios, and after a set has been sent to every public depository of government publications the remainder will be placed on sale.

Chicago wants a deep waterway to the sea, and in their report to the Chicago Board of Trade Messrs. L. E. Cooley and J. S. Dunham formally state the demands of the Northwest. These demands are, briefly, that a depth of 20 ft. shall be maintained for all channels through the lakes and their seaboard connections, and that all permanent work shall be arranged for a depth of not less than 26 ft., so that a deeper channel can be secured wherever the needs of commerce warrant it. The late Deep Waterways Convention, at Toronto, adopted resolutions covering practically the same ground, and recommended the appointment of a joint commission, by the United States and Canadian governments, to decide upon all matters of an international character. Meanwhile, Mr. Cooley admits that the chief demand for this deep channel to the sea comes from the extreme Northwest. In the cities on Lakes Michigan and Erie the sentiment in favor of it is not so extreme; and in sections nearer to the seaboard the feeling is lukewarm, indifferent, or even hostile.

A new oil region is claimed to have been found in Luzerne county, Pa., in the Huntington valley. The Eastern Pennsylvania Oil Co. has been organized to develop the district and borings are being made over a large tract, extending from Brooklyn, in Susquehanna county, to Auburn, in Schuylkill county. The chief prospector, Mr. E. C. Rosenzi, believes that the rock underlying the district is connected with the Bradford and Olean basins.

The Gull Lake Storage Reservoir, on the headwaters of the Mississippi, and for the survey of which the last Congress passed an appropriation, will be the largest in the system of storage reservoirs in this region. This system will contain five artificial storage reservoirs, formed by damming the upper feeders of the Mississippi River. The first dam is in the river itself at Pokegama Falls, the next is 100 miles above, at the outlet of Lake Winnebegoshish, which creates a water surface of 161.26 sq. miles, with a capacity of 45,813 million cu. ft. of water. The other dams are at the outlet of Leech Lake, on the Leech River, at Sandy Lake and at Pine River. Gull Lake lies west of Brainerd, Minn., and empties by the Gull and Crow Wing rivers into the Mississippi. This storage system of reservoirs has proved its efficiency during the past dry summer in maintaining navigation in the Mississippi as far south as Lake Pepin. The entire system has thus far cost about $750,000, and impounds about 90,000 million cu. ft. of water. The Gull Lake reservoir would increase this storage by about 50%.

Brick pavement is now in use in many cities in this country, and the total mileage now laid probably exceeds 300 miles. Reports as to the satisfaction which it gives, however, still vary very greatly. Grand Rapids, Mich., reports, through a special committee of its board of public works, that brick will do for alleys, but asphalt is recommended for ease in hauling, freedom from noise and best sanitary conditions. Two streets are paved in that city with Hallwood blocks and with Canton pavers, and they are reported as equal in appearance to any brick-paved streets in other cities visited; but the committee thinks a better material should be used, and recommends asphalt. City Engineer Cappelen, of Minneapolis, has been inspecting brick pavements in Chicago, and reports that the Purington oil-burned vitrified brick pavement laid on La Salle St., about sixty days ago, is already in bad shape, with many of the bricks chipped and broken. He does not recommend them for Nicollet Ave. in his city. Detroit, according to Secretary McPherston, of the local board, will largely substitute brick for asphalt. Griswold St., Detroit, was laid with brick in 1891, and has never "needed repair" since, and on a number of other streets brick pavement has given satisfaction. On Woodward Ave. brick is laid between the car tracks, and the avenue is paved with asphalt; the latter has been repaired a number of times, and the brick is as good as when laid. Mr. Robert E. McMath, President of the Board of Public Works of St. Louis, prefers brick to asphalt, and says brick is the coming pavement. Good paving brick are now made in many different localities, and the quality of the product is constantly improving. In Indianapolis, bad brick were used, and the report is unsatisfactory. Philadelphia has 28 miles of brick pavement, and though some of it has worn badly, more brick pavements are being laid this year. The Commissioner of Public Works of Syracuse, N. Y., says that that city has tried brick for four years and approves of it. It stands all the heavy hauling to the New York Central freight depot in that city. The whole question of the lasting qualities of brick pavement appears to depend upon the kind of brick used, and too much care cannot be exercised in their selection and inspection.

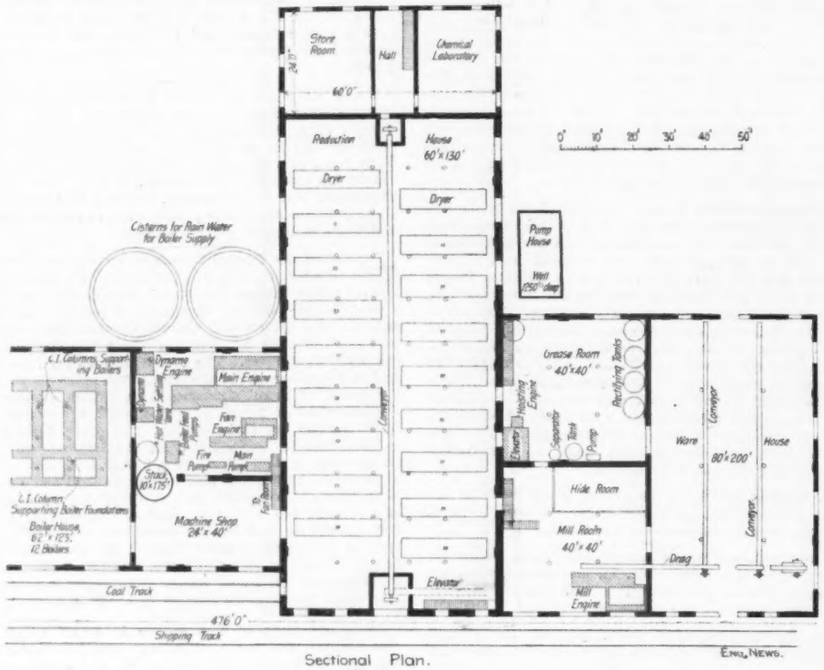
THE MERZ SYSTEM OF GARBAGE UTILIZATION IN FOUR AMERICAN CITIES.

Ten years ago not a city of the United States was disposing of its garbage by any more scientific method than by dumping it on land or at sea, in the most convenient location where it would be tolerated.

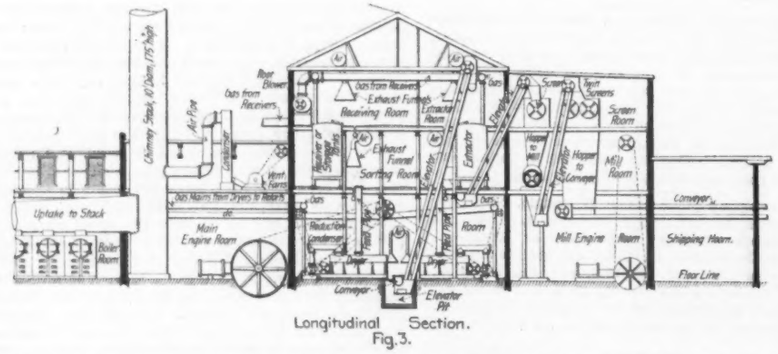
To-day, of the many cities which have adopted some sanitary method of destruction or utilization, four, whose combined population by the last census was over 1,100,000, are employing the Merz system of utilization. The four cities in question, with their respective populations in 1890, are as follows: St. Louis, 452,000; Buffalo, 256,000; Detroit, 206,000; Milwaukee, 204,000.

name from Mr. Joseph Merz, of Bruen, Moravia, a part of Austria-Hungary. In 1882 and 1885 Mr. Merz patented in some of the principal foreign countries an extractor for separating grease from substances containing it by the use of the lighter hydro-carbons. In 1886 Mr. Merz secured a patent on his process in this country. This patent was afterwards purchased and the process was developed and first applied to garbage treatment by the Merz Co. A new extractor has been devised by Mr. Charles W. Preston, of Brooklyn, and many of the mechanical features of the plant have been improved, especial credit being due for this work to Mr. F. G. Wiselogel, M. E., of Indianapolis.

It is the purpose of the following article to describe each of the several plants which have been



Sectional Plan.
Fig. 1.



Longitudinal Section.
Fig. 3.

FIGS. 1 AND 3. PLAN OF MERZ GARBAGE UTILIZATION PLANT OF THE ST. LOUIS SANITARY CO., ST. LOUIS, AND LONGITUDINAL SECTION SHOWING TRAVEL OF MATERIAL THROUGH FACTORY. Mr. F. G. Wiselogel, Engineer; Mr. T. C. Link, Architect.

In each of these cities the disposal plants are owned and operated by local companies, while in Milwaukee and Detroit the local company collects the garbage as well as treats it. The patents under which the local companies operate are controlled by the Merz Universal Extractor & Construction Co., of 788 Broadway, New York. Mr. Louis Fleischmann is president and Mr. Wm. Grevel is secretary of this company. We are indebted to the latter for courtesies extended while collecting information for this article, and also to others named below.

The products obtained in the Merz, as in the other utilization processes, are grease and fertilizing material, the former being extracted by naphtha and the latter being made from the tankage or residue after the grease is extracted. The system derives its

constructed under this system. Much of the information presented has been obtained by personal examinations of the works by members of the staff of this journal.

St. Louis.

The St. Louis Sanitary Co., which has a contract with the city for the treatment of garbage collected throughout the city, has two plants now in operation. One of these plants has been only recently completed, and as it contains the latest improvements known to the art, we shall describe it in considerable detail. The plant is not only the most complete Merz plant in this country, but it is probably far in advance of any other utilization plant in the world in point of size, modern equipment and general thorough construction.

Mr. F. G. Wiselogel, who designed both of the St. Louis factories and also the plant at Milwaukee, has favored us with a full description of this new St. Louis plant. Mr. W. J. Blakely, Secretary of the St. Louis Sanitary Co., and Dr. Geo. Homan, Health Commissioner of St. Louis, have also contributed valuable information concerning its working, all of which we have incorporated in the following description:

The old plant at St. Louis is located in the northern part of the city and has a daily capacity of about 100 tons. The new plant is in the southern part of the city and can treat 200 tons per day. Mr. Blakely states that the old plant cost $185,000 and the new $275,000, including in the latter case a whole city block of land, only half of which is as yet built upon.

The new factory stands in a ravine, close by the Mississippi River. A switch from the St. Louis, Iron Mountain & Southern Ry. runs along its east front, nearly on a level with the first floor, as shown in Fig. 1. The upper, or third, floor is slightly above the street on the west, as may be seen in the view, Fig. 2. The buildings are of brick, with stone foundations. They are divided by fire walls and iron doors, to make practically five separate structures. Most of the roofs are of tar and gravel, but those of the reduction house and of the building back of the mill house are of iron.

The boiler house contains 12 125-HP. horizontal boilers, set independently. Each measures 5½ × 22 ft., with 20 6-in. flues, and each has a steam drum, a mud drum, and a Hawley down-draft furnace. A Wiselogel retort for burning noxious gases from the garbage receivers and driers is built into the furnace. The furnaces are connected by an uptake with a 10 × 175-ft. wrought iron smokestack, and the boilers connect with a 16-in. main steam pipe.

The machine shop is 24 × 40 ft., one story high, has a cement floor, and contains a forge, lathe, drill, press and pipe-cutting machines.

The engine room is 36 × 40 ft. and 18 ft. high. It has a cement floor and is ceiled with yellow pine. It contains three engines, with an aggregate capacity of 346 HP. The main engine is a 250-HP. Hamilton-Corliss; the fan engine is a 60-HP. slide valve, and the dynamo engine is a 36-HP. Rice automatic. This latter machine drives a dynamo which furnishes current for about 250 32-c. p. incandescent and four arc lamps. There are three duplex pumps, one with a daily capacity of about 525,000 gallons and the two smaller ones capable of handling about 225,000 gallons a day.

Over the engine room is a 36 × 40-ft. fan room, with an asphalt floor. Here are located five No. 8 exhaust fans, made by the Garden City Fan Co., of Chicago. These fans are used for ventilating the plant.

On the first floor of the main reduction house, which is 60 × 130 ft., are 16 Eureka driers, designed and patented by Mr. Wiselogel, with a conveyor running between the two rows, as shown in Fig. 1. The second floor is the sorting room, and contains, besides the sorting space, eight garbage-receiving tanks and four Preston extractors, each 8½ ft. in diameter and 14 ft. high. These tanks and extractors extend through the ceiling and slightly above the third floor, which is divided into a receiving and an extraction room.

The first floor of the reduction house is of granitoid, a mixture of crushed granite and cement, and the other two of asphalt.

Back of the reduction house is a three-story lean-to, 24 × 60 ft., which serves as an office and scale house. Each floor and ceiling is of yellow pine, the ceilings finished in oil. On the first floor is the superintendent's laboratory and a storeroom. Next above are the men's closets, bath and dressing rooms. At the top the wagon scale is in the center, the weighmaster's office on one side and the superintendent's on the other. A covered driveway leads from the top floor to the street, as may be seen in the view, Fig. 2.

The mill house adjoins the reduction house on the northeast. It is 40 ft. square, three stories high, has a lower floor of granitoid and two upper floors of yellow pine. On the first floor is an engine room and a 75-HP. slide-valve engine. A 60-in. Steadman bone mill is located on the second floor, and three large revolving screens are on the top floor, all as shown in Fig. 3.

Back of the mill house is another house, 40 ft. sq. and four stories high. In the basement are an Otis hoisting engine and elevator, rectifying tanks and a duplex oil pump with a daily capacity of 144,000 gallons, made by the Stilwell-Bierce & Smith-Vaile Co., of Dayton, O. The second floor is used for experimental purposes. The purpose of the third floor is not stated. On the fourth floor are two 10 × 16-ft. iron water storage tanks. The top floor is of yellow pine, the two middle floors are of asphalt and the basement floor of granitoid.

The 80 × 100-ft. warehouse, shown in Fig. 1, is one story high and has a yellow pine floor.

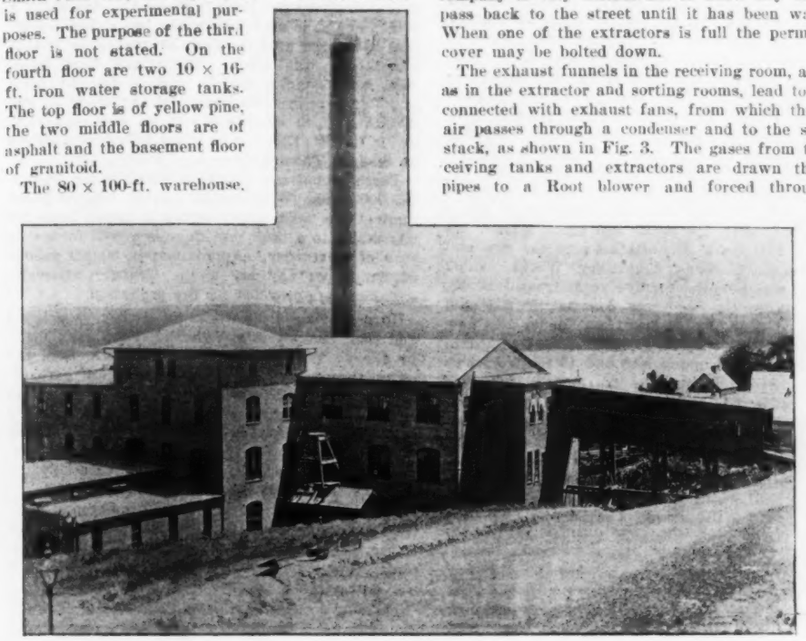


FIG. 2. VIEW OF NEW GARBAGE PLANT AT ST. LOUIS.

An 8-in. artesian well, 1,250 ft. deep, furnishes water for the whole plant. The building is fitted throughout with Grinnell automatic sprinklers. Each floor is supplied with hose for washing and fire purposes, and each foreman is held responsible for the order and cleanliness of his department.

The garbage carts pass up the driveway and stop at the scales, where each is weighed by an official appointed by the city, and then dumps its load in one of the receiving tanks, Fig. 3. As soon as a cart is dumped the tank is closed with a temporary cover, shown in the view, Fig. 4. The cart is then taken to a washing stand and washed inside and out with hot water. Mr. Wiselogel states that the company is very careful not to allow any cart to pass back to the street until it has been washed. When one of the extractors is full the permanent cover may be bolted down.

The exhaust funnels in the receiving room, as well as in the extractor and sorting rooms, lead to pipes connected with exhaust fans, from which the foul air passes through a condenser and to the smoke-stack, as shown in Fig. 3. The gases from the receiving tanks and extractors are drawn through pipes to a Root blower and forced through a condenser, not shown in Fig. 3, to the gas retorts.

From doors at the bottom of the receiving tanks, Fig. 3, the garbage is withdrawn as wanted upon the floor of the sorting room, where tin cans and other foreign substances are sorted out before the garbage is shot down the feed pipes into the driers.

The driers are steam-jacketed, elliptical-shaped chambers, 4 ft. wide, 5 ft. high inside and 16 ft. long. They are provided with a revolving central shaft and reel to keep the material stirred up. The inner shells of the driers are of cast iron, tapering from a thickness of 2 ins. at the bottom to 1 in. at the top, and with ribs 3 ins. wide and 1 in. thick, all as shown in the sections and elevations, Fig. 5. The annular steam space between the shells is 6 ins. wide and surrounds only the lower two-thirds of the driers. The outer shell is of ⅝-in. steel, with ends or heads of cast iron. The belting and gearing which turns the reels, or agitators, in the driers is shown by the section, Fig. 5, and the view, Fig. 6.

The vapors and gases driven off during the process of drying are drawn to Wiselogel condensers at the outer end of each of the driers, shown in detail in Fig. 3 and also in Figs. 5 and 6. Here they are sprayed in the water column condenser, the condensed vapors passing to the sewer and the uncondensed gases being forced through pipes to the retorts in the boiler furnaces by means of the blowers, one of which is shown in Figs. 3 and 6. A chemical analysis of the water of condensation made by Dr. Washburn showed a slight turbidity, acid reaction, no chlorine and traces of lime, nitrites, other oxidizable matter and nitrates.

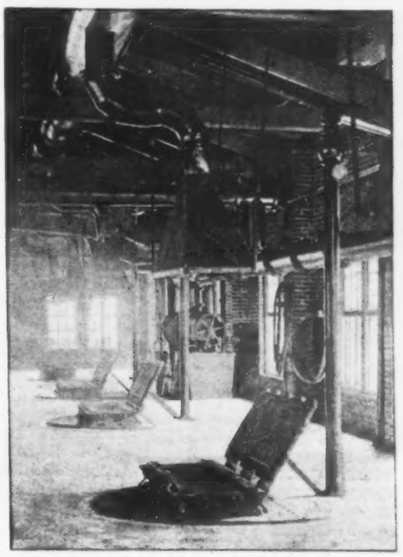


Fig. 4. Corner of Receiving Room.

After the material is dry it is automatically discharged through doors at the rear ends of the driers, Figs. 1, 3, 5 and 7, into the conveyor beneath the passageway and leading to the elevator to the extracting room on the third floor. From the elevator it may be spouted directly into any one of the four extractors.

The conveyors were designed by Mr. Wiselogel. They are of cast iron, with a 12-in. diameter and pitch. The flights are in sections and slip on a central shaft. The hub of each flight has cast on it a male and female clutch. The trough is of ½-in. cast iron.

When an extractor is full, its cover is bolted down and naphtha is admitted at the bottom until the material is submerged. A gentle heat is maintained by steam in a coil in the extractor, and the whole mass is allowed to soak for two or more hours, while the naphtha takes up the grease. The solution of naphtha and grease is then drawn off through suitable pipes into an evaporator, where the naphtha is vaporized. The vapor is led to a condenser and liquefied, and the liquid flows back into the naphtha storage tank, ready to be used again. The grease is drawn from the evaporator into a purifier and afterwards pumped into storage tanks for further treatment or for shipment. The St. Louis extractors are made of steel.

The original Merz extractor is shown by Fig. 8, and that used at St. Louis by Fig. 9, each taken from patent specifications.

In the Merz extractor, Fig. 8, a garbage tank is enclosed in a larger tank, with a space all around it. The solvent flows to the garbage tank, and when it reaches the necessary level, passes through the siphon into the outer tank. Steam can be admitted to the steam coil when desired to volatilize the solvent, which will pass up to and through the cooler and condenser for use again. The grease can be drawn off from the bottom of the outer tank as desired.

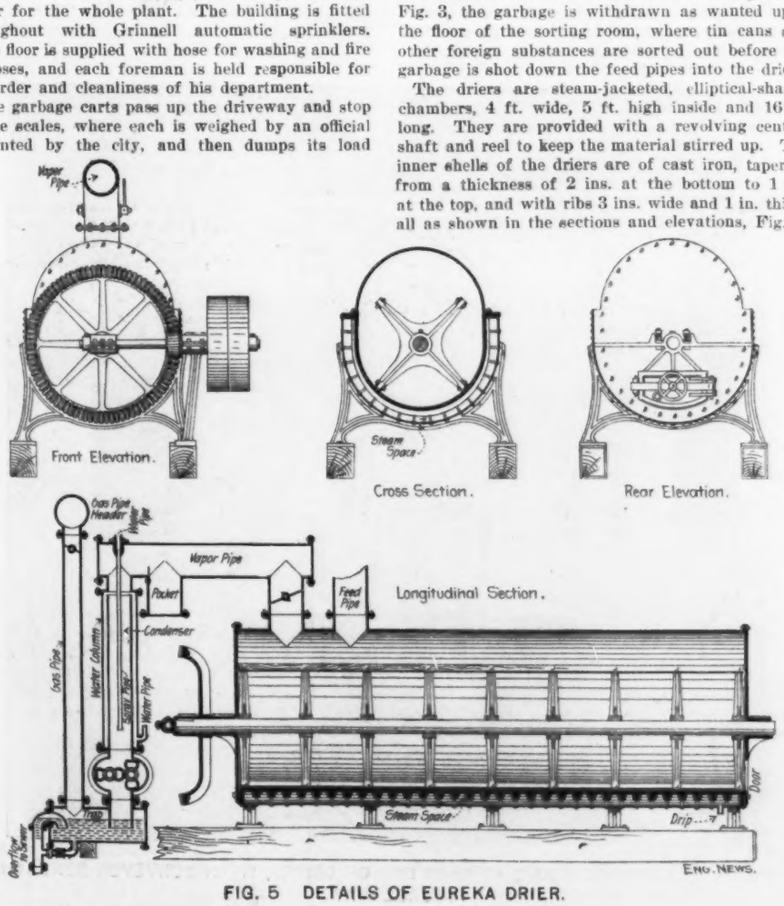


FIG. 5 DETAILS OF EUREKA DRIER.

The extractors used at St. Louis were invented by Mr. Charles W. Preston, of Brooklyn, and were patented April 4, 1893 (No. 494,647), the patent being assigned to the Merz Co. In the Preston extractors, as originally designed, naphtha passes from the solvent tank, Fig. 9, into the garbage tank and permeates the material there. The mass may be heated by the steam coil located below the perforated bottom of the tank, or by live steam. The solvent, charged with fatty matters, and accompanied with water, passes down through the pipe at the bottom of the tank and to the lower separator, where the water passes out through the gravity overflow, and the solvent and oil goes to

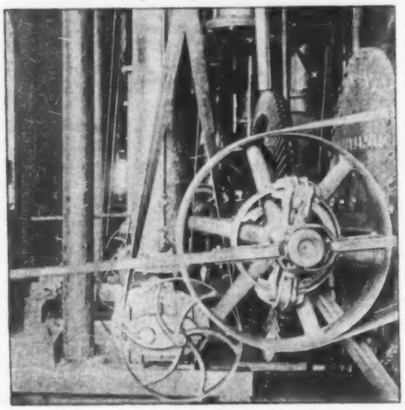


Fig. 6. Driving Gear and Condenser of Eureka Drier.

the vaporizer below. Live steam may be admitted to the vaporizer, as shown. The vaporized solvent rises to the condenser, while the grease flows out below. To remove any water which may form in the condenser from aqueous vapor carried up with the vaporized solvent, a second condenser is provided, as shown in Fig. 9. The tankage is raked out through doors at the bottom of the extractors into conveyors, as may be seen in Fig. 3, which carry it to the hopper of the first screen in the screening room. Here such objectionable matter as escaped the sorters in the sorting room is retained before the tankage passes down to the bone mill. From this mill the material passes up the elevators to the twin screens, where all coarse material is removed, after which the commercial product goes by conveyors to the shipping room to be sacked or otherwise packed for shipment to manufacturers of artificial fertilizers. Mr. Blakely, Secretary of the St. Louis Sanitary Co., informs us that the final tankage removed from the extractors appears and smells like coffee grounds or chicory, and that the ground product is as fine as corn meal.

The floors of the receiving, sorting and reducing rooms are all drained by a system of gutters and pipes.

The old factory at St. Louis has five extractors and 16 driers, and each factory is said to employ about 20 skilled and 20 unskilled laborers, although the new factory has double the capacity of the old. Through the later spring and all the summer months, Mr. Blakely states, the factories are run day and night, so that while the number of common laborers increases or diminishes a little from time to time, the whole force of the company, including day and night shifts, number between 80 and 100 men.

The St. Louis Sanitary Co. has a contract with the city of St. Louis, by which it agrees to treat all garbage delivered at the works. The contract extends for 10 years from Oct. 23, 1891, and provides for the payment by the city of $1.80 per ton of garbage treated up to an average of 100 tons per day. All over this amount the company has agreed to treat free of charge. From Jan. 1, 1892, to the end of August, 1894, or 2⅔ years, the total amount of garbage received was 89,319 tons, of which 36,010 tons was for the year ending Aug. 31, 1894, and 7,034 tons for the month of August last. The average daily amount of garbage during the 974 days of the full period was a little short of 90 tons, for the year ending Aug. 31, 1894, a little over 98 tons and in the month of August 227 tons. August is a month in which garbage collections are very heavy. The daily record for August, 1894, will be given in connection with similar figures from the other cities employing this system.

Buffalo.

The Merz system was introduced in Buffalo in the fall of 1888 by a Mr. Baynes, who was then under contract to dispose of the city's garbage. Prior to this various methods of disposal had been tried. Some garbage had been used by farmers as a fertilizer and some had been unceremoniously dumped into the Niagara River. This latter practice gave rise to complaints from the towns below drawing water supplies from the river and had to be stopped. The quantity of garbage available at this time did not yield sufficient products to pay running expenses, and so the plant was closed after 18 months' use.

In June, 1891, the plant was again started up, under a two years' contract between the city and the Baynes Garbage Crematory Works, which contract was renewed for five years from June 19, 1893. During the two years' contract the city paid $20,000 a year for disposal, and under the new contract it pays $35,000 a year, without regard to quantity. The company is bound to receive whatever garbage is brought by the city, in whatever manner collected. A city ordinance, however, provides that ashes and tin cans must be kept out of the garbage, but, like too many city ordinances, this is more honored in the breach than the observance, the principal breaches being in the matter of cans, bottles and similar substances. The company is bound to dispose of its garbage in a sanitary manner and to protect the city against all suits for nuisances occasioned by the works.

Mr. J. N. McArthur is treasurer of the company, and to him we are largely indebted for the information regarding this plant. Mr. Ernest Wende, M. D., Health Commissioner of Buffalo, and Mr. John S. O'Shea, Superintendent of Streets, have also given us information, and on Sept. 25 a member of the staff of this journal made a personal examination of the disposal works.

The plant is located about four miles from the city hall and some 600 ft. outside the easterly line of the city, near the Lehigh Valley, Erie and Lackawanna railway tracks. The buildings are of wood. The main factory is two and three stories high, 34 × 160 ft. in plan. The boiler house is 60 × 80 ft., one story high, some 20 ft. from the main building. A grease storage room and office are contained in a one-story building, 25 × 40 ft.

A boiler capacity of 300 HP. is provided by four horizontal tubular boilers, recently equipped with forced draft by the Buffalo Forge Co., for which a 6-HP. engine is used. Since the late strike, screenings have been used for fuel, but previously run-of-mine coal was used. There are four 35-in. steel smokestacks, 60 ft. high. In the main building there are two horizontal engines of 75 and 60 HP., which operate the driers and conveyors, and a 12-HP. Tifft engine in the boiler room drives an 80-light Thomson-Houston dynamo.

Three pumps are in use, a small boiler feed, a 175,000-gallon Worthington and a 160,000-gallon Snow. The main water supply is drawn from the city mains to a tank, but there is a well for use in case of emergency. Approximately 50,000 gallons of water per day are used. Granger automatic sprinklers are provided for fire protection.

Upon arriving at the works the garbage is weighed and then dumped into V-shaped dump cars, made by the C. W. Hunt Co., of New York, each car being large enough to hold one cart-load of garbage. The cars are pushed on a track to an elevator and raised to the third story of the building, where their contents are dumped into receiving tanks, of which there are four. The further journey of the material need not be described, as it is essentially the same as detailed at the St. Louis works.

There are 13 horizontal driers on the ground floor, each approximately 5 ft. in diameter and 14 ft. in length, made by the Bigelow Co., of New Haven, Conn. Seven of these are run by the 75-HP. and six by the 60-HP. engine.

There are three extractors, and these, like the driers, are 8 ft. in diameter and 14 ft. long, placed on end. The receiving tanks and extractors together have a capacity of about 160 tons of garbage, but the present steam and drier equipment limits the capacity of the plant to 65 to 70 tons in 24 hours. Chain and belt conveyors and bucket elevators are used to move the garbage after the treatment begins. A 3-ft. Denmead bone mill, driven by the 75-HP. engine, is used to grind the bones and tailings from the tankage screen.

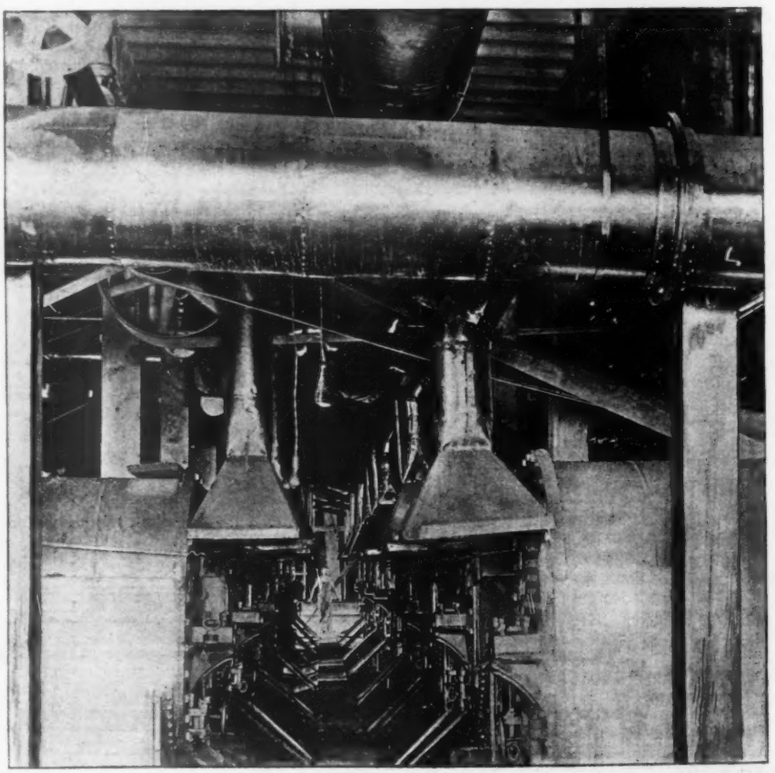


FIG. 7. DISCHARGE DOORS AT REAR END OF DRIERS, WITH CONVEYOR BENEATH PASSAGE-WAY.

The tankage is loaded into wagons and hauled to cars for shipment in bulk.

The grease passes to a 5 × 7-ft. separating tank, from which any remaining water may be drawn into a sewer just put in to connect with the Buffalo sewerage system. The grease is pumped by a No.

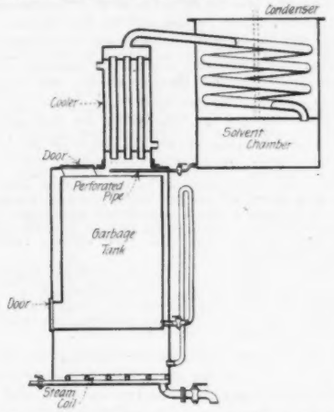


Fig. 8. Section Through Original Merz Extractor.

4 Blake pump from this tank into two storage tanks, from which it is drawn into barrels for shipment.

Mr. McArthur states that the garbage yields from 1 to 3% of its weight of grease, varying with the season, and being at the maximum in the winter. He also states that the marketable tankage averages about 20% by weight of the garbage treated. The clear glass sorted from the garbage is sold to the Lancaster Glass Works, of Lancaster, N. Y., for $8 to $9 per ton, delivered at the glass works. At the garbage works this glass might bring $5 per ton. Dark-colored glass, especially Bass' ale bottles, is not marketable at Buffalo.

Tin cans are not utilized at Buffalo, but might be disposed of by melting off the solder and running the scrap into pigs or casting it for window weights; or the cans might be cleaned and pressed into bales for sale in that form.

The works are in operation day and night. An aggregate of 27 men are employed in each shift, including a superintendent, extractor and dryer men, engineers and laborers.

The yearly amount of garbage treated has increased, Mr. McArthur states, from 4,500 tons at the start to probably 15,000 tons during the current year, the increase being due somewhat to the growth of the city, but chiefly to the more systematic collection. Mr. John S. O'Shea, Superintendent of Streets, states that for the year ending June 30, 1894, the amount of garbage collected was 17,043 tons. The maximum amount of garbage which the works can treat, as already stated, is 70 tons per day. The minimum amount received during the past year was 22 tons, on an inclement day last winter. The daily amounts of garbage for August, 1894, are given further on.

Milwaukee.

The story of garbage disposal at Milwaukee prior to the installation of the Merz system by the Wisconsin Rendering Co. in 1892 is a story of many difficulties and of experiences of the most varied character.

In October, 1888, a three-years' contract for the disposal of garbage and small dead animals was awarded to Wm. Forrestal and others, known as the Forrestal Crematory & Garbage Co. Cremation was first tried by this company, and finally the Merz system was introduced. The plant was located within the city limits, in the Menomonee Valley. It was badly constructed and improperly operated, if reports are true. On Feb. 2, 1891, the city authorities annulled the contract with the company, the annulment taking effect May 1, some five or six months before its natural expiration. In the next few months arrangements were successively made to dispose of the garbage on farm land in the adjoining town of Milwaukee and in the town of Greenfield, and such disposal was prohibited in each case by the town authorities within less than a month after beginning operations. From August, 1891, until July, 1892, when the present plant was first put in operation, the city's garbage was dumped from boats into Lake Michigan.

The authorities of Milwaukee seem to have been satisfied with the Merz system from their first experience with it, although not pleased with the location, construction and operation of the original plant. Within two months from the closing of the old Merz plant the present contractors put in a bid for treating the garbage by the Merz system, and the common council on Aug. 10, 1891, passed an order awarding the contract to the Wisconsin Rendering Co., but the mayor vetoed the order. In February, 1892, garbage disposal plants in various cities were visited by a committee, consisting of the city engineer, health commissioner, mayor and president of the council. This committee recommended the Merz system, and the council adopted the recommendations. On March 12, 1892, the city contracted for the disposal of garbage by the Merz system, and on June 25, the Wisconsin Rendering Co., as assignee of the contractor, Mr. Henry A. Fleischmann, commenced work for the removal and disposition of garbage, the first boatload of garbage leaving the wharf on July 6.

The present plant is located at Bartel's, Ozaukee Co., Wis., on the shore of Lake Michigan, some 15 miles north of the city by rail and 20 miles by lake. Here the company owns 57 acres of land in a farming district. Cottages and a boarding house for the employees, all owned by the company, are the only houses near the works. The Ashland division of the Chicago & Northwestern Ry. runs near the works, and the garbage company has connected its factory with the railway, and moves cars back and forth with horses. This means of propulsion has been necessary because of the refusal of the railway company to build a switch or even to furnish a switching engine, owing to its prejudice against the location of the plant near its tracks. Recently the railway people have regarded the plant with more favor, and have even talked of hauling garbage. A general plan of the works is shown by Fig. 10.

The plant is located on a bluff about 300 ft. from and 80 to 100 ft. above the lake. A pile and timber dock extends into the lake, and on this two 30-in. gage tracks have been laid, converging into a single track near the shore. This track runs up the bluff and to the receiving room on the second floor of the main building. Garbage is hoisted from the barge at the dock by means of iron buckets and a derrick, and emptied into dump cars with wooden boxes, which are hauled by a cable up the incline to the works.

The main building is three stories high and 100 × 150 ft. in plan; the extractor building is 25 × 60 ft., also three stories high; the mill building is 25 × 50 ft. All these buildings are of wood, with stone foundations and gravel roofs. The floor of the receiving room is of cement. The smoke stack is of No. 8 steel, 6 ft. in diameter and 80 ft. high.

There are seven 100-HP. boilers; a 125-HP. Corliss engine, which operates the driers and all machinery; two 170,000-gallon Worthington pumps; four Sturtevant exhaust fans, one each Nos. 4 and 6 and two No. 7; four Merz extractors and 12 16-ft. driers, eight of the latter being Hogle driers and four being Eureka driers. There is a grinding mill with a 16-ft. screen; a cast iron worm conveyor 125 ft. long and a bucket conveyor for transferring the garbage from the driers on the first floor of the main building to the second floor of the extractor house, from which it is shoveled into the extractors. The water supply is pumped from the lake, the pump house being located on the shore, and the consumption being about 200 gallons per minute, or at the rate of 288,000 gallons per day.

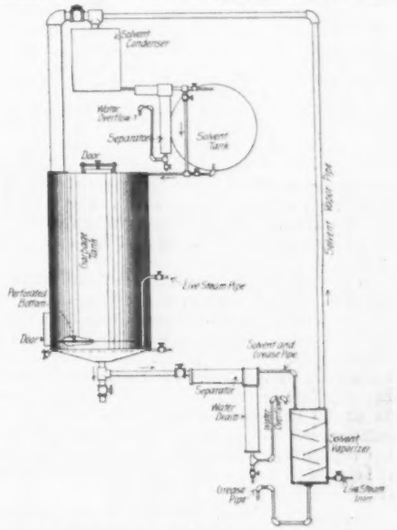


Fig. 9. Preston Extractor Used in the Improved Merz Process.

The Eureka driers are considered by the company as preferable to the Hogle, as being less complicated; it is said that the drying capacity of each is about the same.

The receiving room is in the main building, over the boilers, engine, condensers, driers and grease tanks, and beneath the room or floor used for skinning dead animals. The tankage is loaded through chutes into box cars for shipment.

All the gases which pass the condensers go to the furnaces, and all the waste water, after passing through two straw and gravel filters, goes to the lake.

Dead animals are treated in a rendering tank separate from the garbage, and the resulting grease is kept by itself, the company stating that it is superior to that derived from the garbage.

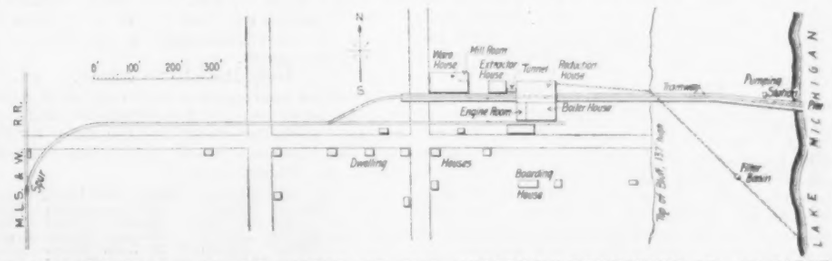


FIG. 10. GENERAL PLAN OF WORKS OF THE WISCONSIN RENDERING CO., AT BARTEL WIS., FOR THE TREATMENT OF THE GARBAGE OF MILWAUKEE.

The force employed at the disposal plant is 35 men, most of whom, the company states, are skilled laborers. The company also states that its coal consumption is 800 tons per month, or 9,600 tons per year of best Pittsburg coal.

Regarding the amount of garbage handled by the company and the compensation for the same, Mr. Fred C. Gross, President of the company, states that during the two years the company has been in operation the average amount of garbage has been 1,600 tons per month, which would be 19,200 tons a year. Mr. Gross also states that for collection the company receives $33,000 a year, and for treatment $25,000, regardless of amount. If to this is added the $10,000 which it is reported the city pays for lake transportation, the total cost of collection and disposal would amount to $68,000, which agrees with the figures given in the last annual report of the Milwaukee Commissioner of Health, where it is stated that $43,000 was paid during the calendar year 1893 for collection, and

$26,000 for treatment, an extra $1,000 having been allowed for the last six months of the year "according to the terms of the contract," which provides for $2,000 additional each year for treatment. This was the first full calendar year the works had been in operation.

The contract provides that at its expiration, in 1897, the city may buy the works at a stipulated price, or in case of disagreement as to the fairness of the sum, at a price to be fixed by arbitration.

Dr. Walter Kempster, Commissioner of Health of Milwaukee, informs us that in August, 1894, 2,863 loads of garbage were collected in 27 working days, an average of 106 loads per day. The average weight of each load is given as 1,320 lbs., which would make the total amount collected about 1,890 tons, or some 70 tons a day. For the month of September, 1894, Mr. Gross states that 61 tons of garbage per day, or a total of 1,830 tons, were treated.

In the city health reports the garbage handled is given in cubic yards, and it is assumed that 3 cu. yds. weigh one ton. This seems a very light weight, but local conditions might explain it. The health authorities are satisfied that the above basis of weight is a correct one. The total amount of garbage handled in 1893 is given in the health report as 44,100 cu. yds., for which the city paid the company $69,000, or $1.564 per cu. yd. Assuming the population of Milwaukee as 255,000 for 1893 the cost of garbage collection and disposal was 27.1 cts. per inhabitant.

Mr. Fred C. Gross, President of the Wisconsin Rendering Co., writes us that trouble is caused by the mixing of ashes and garbage, and that the city has passed an ordinance prohibiting such mixing, but has never taken active steps to prevent it. The contract provides that garbage containing tin cans and ashes need not be collected. It is seldom refused, the company states, because of cans, but is refused when it contains ashes. Dr. Kempster also states that there is some trouble about keeping ashes separate from the garbage, which is being gradually overcome. He adds that the worst feature is the persistency with which tin cans are thrown into the garbage receptacles, making necessary an extra handling of all the garbage to remove this matter so that it will not injure the machinery.

The information regarding the Milwaukee plant has been furnished in part by Mr. Gross and Dr. Kempster, already mentioned. Further information has been obtained from the various annual health reports of the city of Milwaukee, and by a personal visit by a member of the staff of this Journal on Sept. 29.

Detroit.

Like Milwaukee, Detroit has its garbage both collected and treated by a single contractor, and like that city it also tried cremation before adopting the Merz system. The garbage at Detroit is handled by the Detroit Sanitary Works, of which Mr. M. H. Chamberlain is manager. The company receives for its services the lump sum of $52,500 a year, under a three-years' contract, but gives a rebate of 80 cts. a ton for all garbage in excess of 10,000 tons per annum, guaranteeing to pay the city a sufficient sum to defray the expenses of a garbage department under the control of the board of health, consisting of an office clerk, and two mounted special police officers, which the city is bound to provide. For the year ending June 30, 1894, the amount of garbage handled, as stated by the company, was 28,294,561 lbs., or 14,147 tons. At 80 cts. a ton the rebate on 4,147 tons would be $3,318, which may be taken as approximately equal to the cost of maintaining the garbage department mentioned just above. For the year named, therefore, the cost of collecting and disposing of 14,147 tons of garbage may be taken as $52,500, or $3.71 a ton. The monthly record in pounds of garbage treated for the year ending June 30, 1894, as reported by the health authorities, was as follows:

July	2,786,950	January	1,840,825
August	3,300,075	February	1,439,185
September	3,387,959	March	1,887,480
October	2,658,035	April	1,913,155
November	2,124,555	May	2,537,245
December	1,997,485	June	2,552,077
Total for year			28,425,026 lbs.

This total differs by 130,000 lbs., or 65 tons, from that reported by the company, but the average in either case is about 39 tons a day, the heaviest monthly collection being in September, 56 tons a day, and the lightest in February, only 24 tons a day.

The works are covered by six detached buildings, as follows: Office; boiler room, engine room and machine shop, about 80 × 100 ft.; receiving and drying house, 48 × 165 ft.; extractor, mill and screening room, 32 × 100 ft.; tankage warehouse, 48 × 100 ft.; fertilizer manufactory and warehouse, 48 × 100 ft.

These buildings are located on the Huron River, at French Landing, Mich., about 20 miles from the city limits. The garbage is collected in four-wheeled wagons, with removable steel boxes, holding about 3,000 lbs. each. The full boxes are lifted from the wagons at the shipping station and conveyed to cars owned by the company by means of an overhead trolley. This method is also used for unloading at the factory. On its arrival, the garbage is dumped directly into the driers, a practice not followed at the other three cities, owing to the necessity for screening out tin cans. This and allied matter the Detroit company refuses to remove, and the city aids in keeping it out of the garbage receptacles.

Six tubular boilers rated at 100 HP. each are in use, and four engines are provided, two large and two small. One of the large engines is held in reserve. One of the small engines runs an electric lighting dynamo when neither of the large engines is running, and the other small engine is used in the fertilizer department. It may be stated here that the company manufactures the "Clover Leaf" and other brands of fertilizers, thus carrying its processes one step further than the other companies, which sell their tankage to the manufacturers of fertilizing materials, instead of completing the finished product.

Steam-jacketed driers are used, and are obtained as needed. There are four Merz extractors, a number of mills of different makes for grinding the several ingredients handled, and a complete water-supply plant, with duplicate pumps, working ordinarily at 40 lbs., but capable of increasing automatically to 100 lbs. per sq. in., and capable of supplying six 2½-in. streams at the latter pressure, there being twelve hose attachments. The works are run day and night, but the force employed is not stated, nor is the date of expiration of the contract.

We are indebted to Mr. Chamberlain and to Mr. Joseph Schulte, M. D., Acting Health Officer, for the information regarding the Merz system at Detroit. Mr. Zan Schmedding is secretary of the health department.

Daily Records for August.

Attempts were made to secure the daily records for August of the amount of garbage received at the disposal works in each of the four cities, but only the companies at St. Louis and Buffalo responded, giving the following figures:

Aug.	St. Louis.	Buffalo.	Aug.	St. Louis.	Buffalo.
1	428,213	132,610	17	512,884	123,060
2	402,620	113,140	18	500,881	130,730
3	396,654	100,480	19	265,164	Sunday.
4	383,458	122,060	20	509,899	140,720
5	249,724	Sunday.	21	571,743	150,000
6	424,139	142,990	22	552,659	140,880
7	412,151	156,500	23	499,204	102,060
8	469,730	167,830	24	536,337	117,520
9	433,427	115,280	25	489,272	125,140
10	468,393	122,360	26	452,062	Sunday.
11	452,416	127,040	27	522,934	142,880
12	280,170	Sunday.	28	501,671	116,270
13	498,446	152,240	29	541,832	149,140
14	516,231	166,200	30	491,107	121,760
15	517,655	159,100	31	522,338	133,200
16	486,929	109,270			
Total, lbs.				14,069,744	3,589,580
Average, tons				226.887	57.887

The average daily amount of garbage treated at Milwaukee in August was 70 tons. For Detroit no figures are available, but the highest daily average for any month during the year ending June 30, 1894, was 56 tons for September, 1893.

Sanitary Aspects of the Merz System.

Having now described the Merz system of garbage disposal as practiced in St. Louis, Buffalo, Milwaukee and Detroit, a few words regarding the sanitary aspects of the several plants may be of interest. Inspection of the factories at Buffalo and Milwaukee by members of the staff of this journal showed each to be conducted in a sanitary manner, and without offense, so far as a brief visit could determine. The process as now perfected gives every promise of being capable of giving the highest sanitary results.

From the health authorities of the four cities come words of approval regarding the Merz system, with the single exception of St. Louis, where judgment is in part suspended and where some of the complaints are caused by the passage of garbage carts through the streets, which, of course, has no bearing upon the question under discussion. Under date of Aug. 20, 1894, Dr. George Homan, Health Commissioner of St. Louis, wrote to this journal as follows:

I have the honor to state respecting the works of the St. Louis Sanitary Co., that, while I do not doubt their operation is a successful commercial venture, or that the conversion of the offensive animal and vegetable matters treated there into merchantable products is profitably carried on, still with these statements commendation for the present must be suspended in so far as questions of comfort and freedom from annoyance to those in the vicinity of the works are concerned, as the health department has lately received most urgent and bitter complaints from hundreds of persons living near the newer and larger of the two establishments which the company operates, which complaints have been found to have sufficient basis, being due to volatile emanations from the factory, and also effluvia from the wagons conveying garbage.

It may be found, so far as the operation of the factory is concerned, that possibly faulty management or defective mechanical appliances contribute to cause the nuisance noted, and the company is zealously working to remedy the matter, if possible, but what the outcome will be of course is not known.

The St. Louis factories are located within the city limits, and the new one, mentioned as giving rise to the most complaints, is at the foot of a bluff and on the river, but close by a residence section of the city. Doubtless some of the complaints come from people who objected to, and are still protesting against, the location of any sort of garbage disposal works at this point. Under such circumstances some people would complain on principle, no matter how well the works were conducted. Certainly the new St. Louis factory is a model of its kind. The plants for all the other cities, it will be remembered, are located outside the city limits.

A report on the gases and odors issuing from the chimney of the new plant at St. Louis was made on Oct. 3, 1894, by Prof. William M. Chauvenet, of Regis, Chauvenet & Bro., analytic chemists and assayers, of St. Louis. Professor Chauvenet visited the plant on Saturday, Sept. 29, and reports on his experiments and conclusions as follows:

My experiments were conducted while the works were in full operation, and the results were as follows:

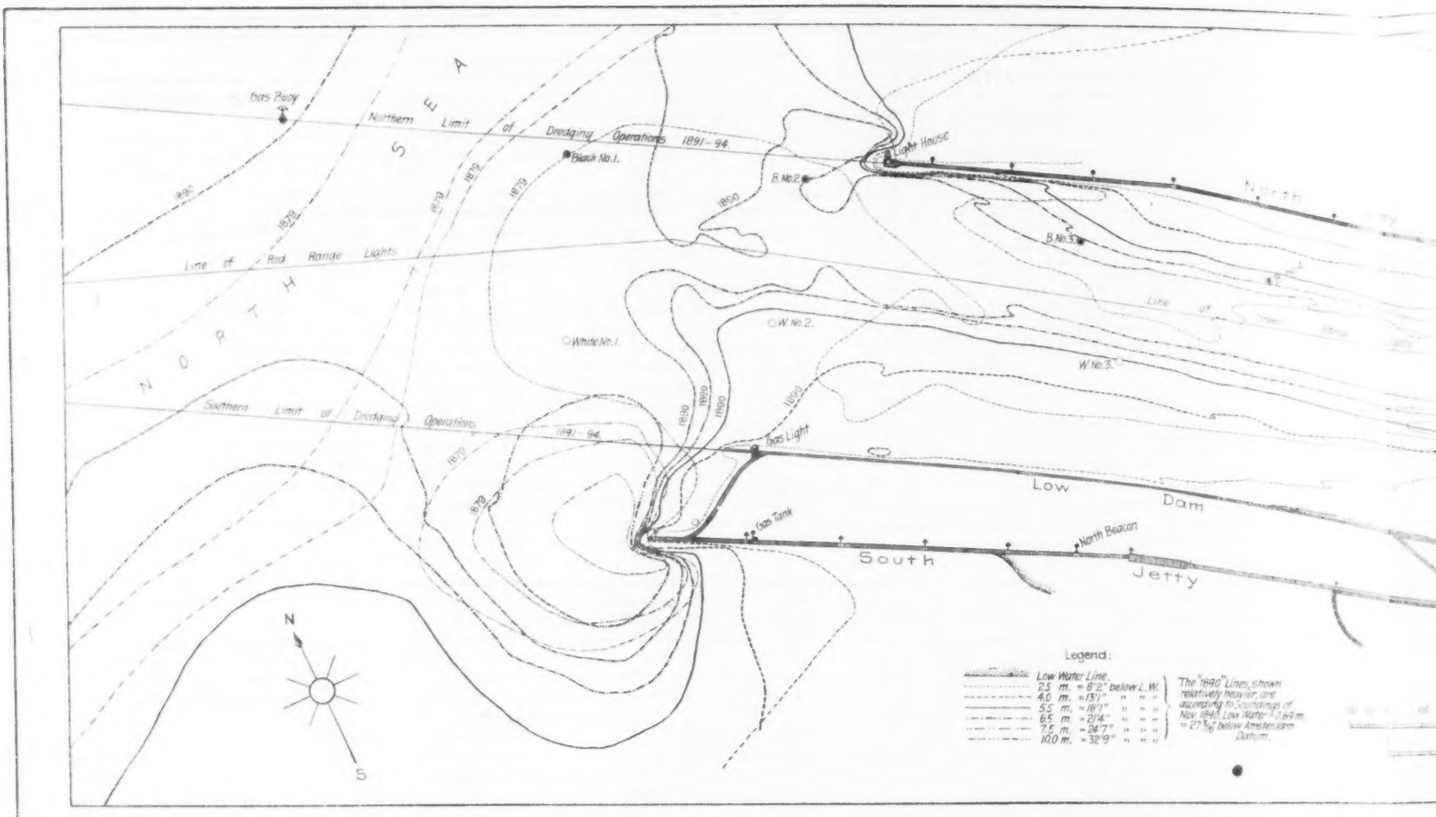
By removing a plug from the larger pipe immediately in rear of the first drier, while in operation (I refer to the pipe which contains the gases from the drier after they have passed through the condenser) access was had to the air and gas within. By introducing a rubber tube connected with a siphon flask and sealing it into the opening, a portion of the air on its way to the stack was siphoned off and collected in the flask for examination. This product has a faintly acid smell, resembling yeast; is free from offensive odor; has no sulphuretted hydrogen and no nitrogenous gases, and is in no respect a source of offense.

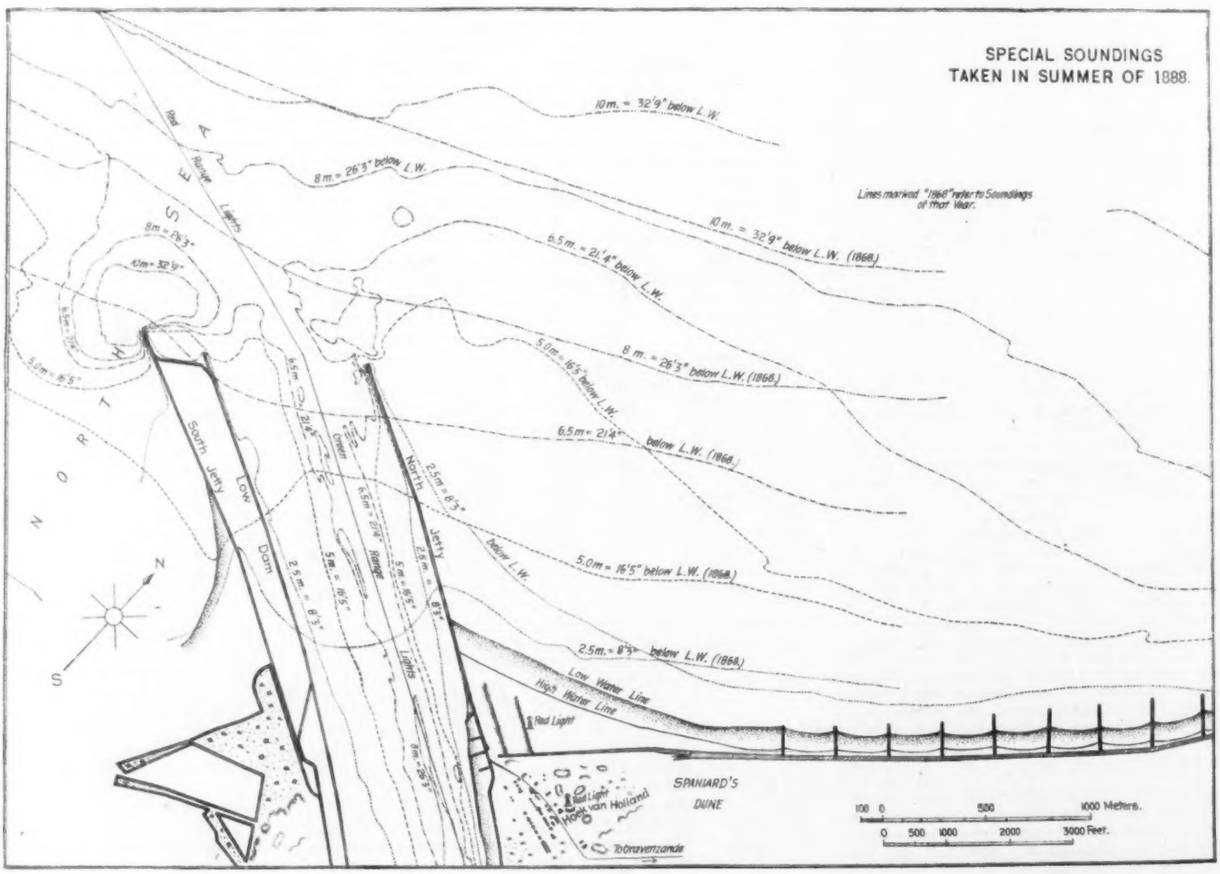
By opening the slide in the top of the large blower pipe near the point where it enters the furnaces on the second floor, the same tests were repeated with identical results.

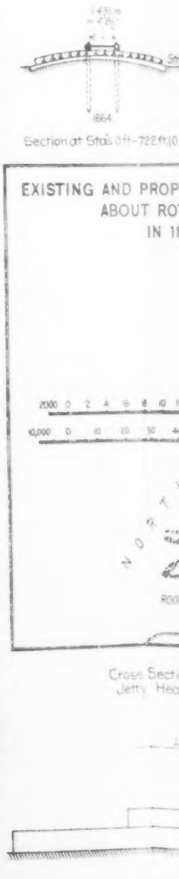
A man was now sent to the top of the high smoke-stack, while I directed him from below. A large sponge was lowered into the stack and allowed to remain there half an hour. Upon removal, though slightly blackened by the smoke, it was wholly odorless and indicated the absence of any acid gas of a foul nature within the stack. When further examined in the laboratory by extraction of its water, no odors of any kind could be detected.

As a more substantial and absolute test, a large siphon bottle, with long rubber connecting tube, was next lowered within the stack. By siphoning off the water, a sample of the atmosphere within the stack was secured and collected within the bottle. This sample was taken to the laboratory and tested in various ways. It proved to have a slight, very faint odor of smoke, but to give forth no other odor whatever. It was absolutely neutral in reaction, failing to affect moist litmus paper. It contained no pungent or odoriferous gases of any kind, and was, in short, nothing more than ordinary coal smoke of a very dilute kind, since, with the smoke consumer in operation, the amount of smoke coming from the stack was very light.

Though these tests at the bottom and top of the stack seem to be upon the same gases, and though it may appear quite useless to test them at the top after they had been proved quite odorless at the bottom, yet, since the gases actually emitted from the top of the stack are the supposed source of bad odors, by many supposed to be the whole cause of complaint, I have gone to the top of the stack to prove, if possible, that there was no smell from the vapors or gases there emitted.


Northern Limit of Dredging Operations 1891-94.
Light House
B. No. 2
B. No. 3
Line of Red Range Lights.
White No. 1.
W. No. 2.
W. No. 3.
Southern Limit of Dredging Operations 1891-94.
Tugs Light
Low Dam
Tugs Tank
North Beacon
South Jetty
Legend:
Low Water Line.
2.5 m. = 8'2" below L.W.
4.0 m. = 13'1" " " "
5.5 m. = 18'1" " " "
6.5 m. = 21'4" " " "
7.5 m. = 24'7" " " "
10.0 m. = 32'9" " " "
The "1890" Lines, shown relatively heavier, are superimposed to Soundings of Nov. 1893. Low Water = 0.68 m. = 27"5/8 below Amsterdam Datum.

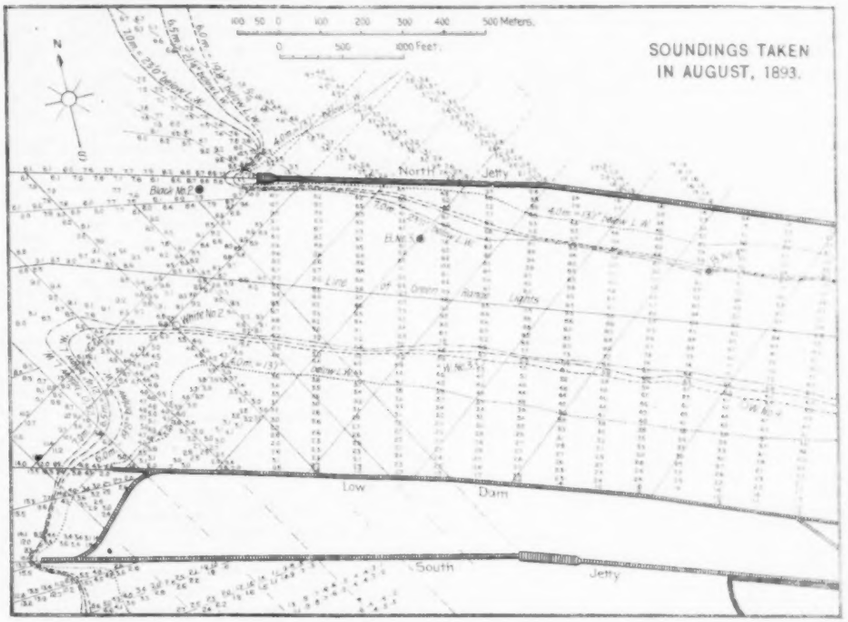

SPECIAL SOUNDINGS
TAKEN IN SUMMER OF 1888.
10 m. = 32'9" below L.W.
8 m. = 26'3" below L.W.
Lines marked "1868" refer to Soundings of that Year.
6.5 m. = 21'4" below L.W. (1868.)
5.0 m. = 16'5" below L.W. (1868.)
2.5 m. = 8'3" below L.W. (1868.)
South Jetty
Low Dam
North Jetty
Range Lights
Low Water Line
High Water Line
Red Light
SPANIARD'S DUNE
Hoek van Holland
Tobraventzande
100 0 500 1000 Meters.
0 500 1000 2000 3000 Feet.

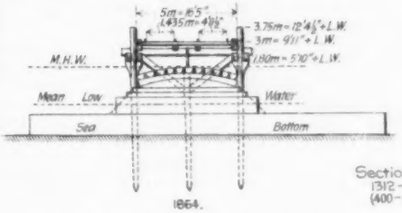


THE NEW WATERWAY TO ROT

CHANGES OF DEPTHS BETWEEN JETTIES
FROM 1879 TO 1890,
SHOWING AREAS TO BE DREDGED.

SOUNDINGS TAKEN
IN AUGUST, 1893.



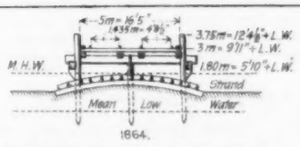


1864.

Section at Sta's. 886 – 1312 ft. (270 – 400 m.)

1864.

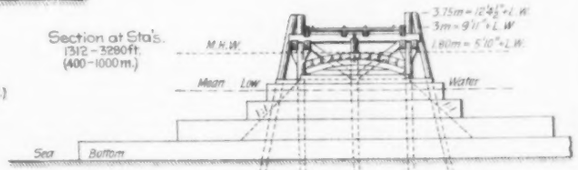
Sta's 0 ft – 722 ft (0 – 220 m.)



1864.

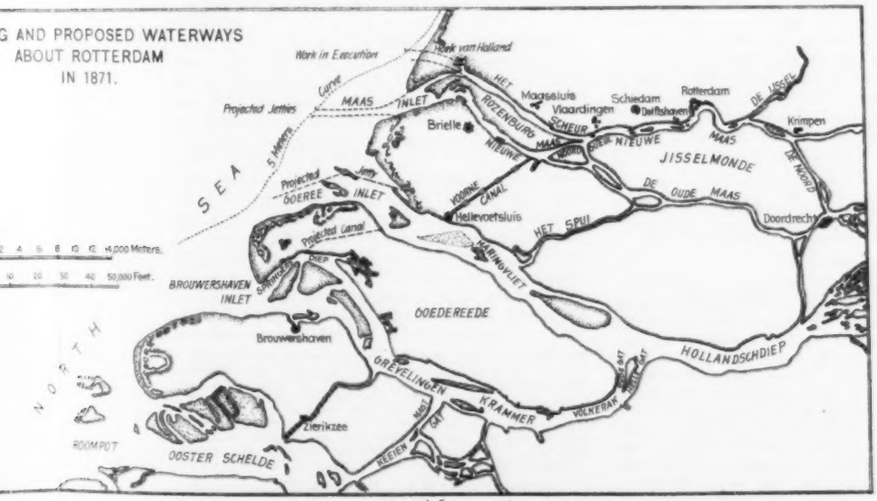
Section at Sta's . 722 – 886 ft (220 – 270 m.)

Section at Sta's.
1312 – 3280 ft.
(400 – 1000 m.)

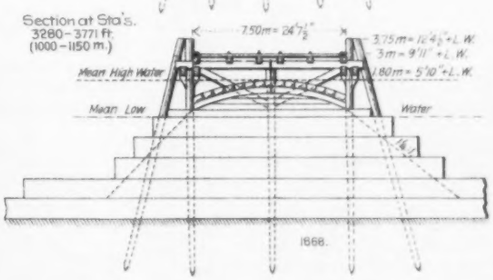


1866.

G AND PROPOSED WATERWAYS
ABOUT ROTTERDAM
IN 1871.

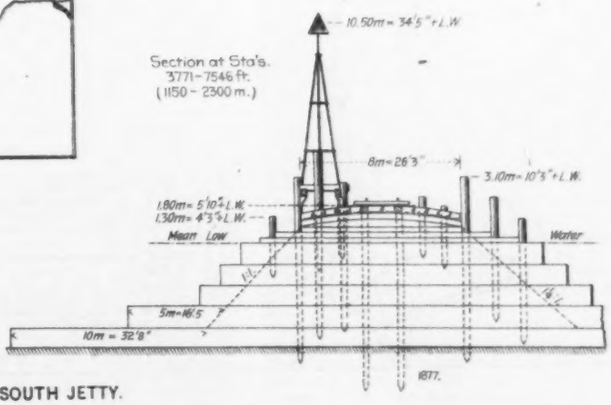


Section at Sta's.
3280 – 3771 ft.
(1000 – 1150 m.)



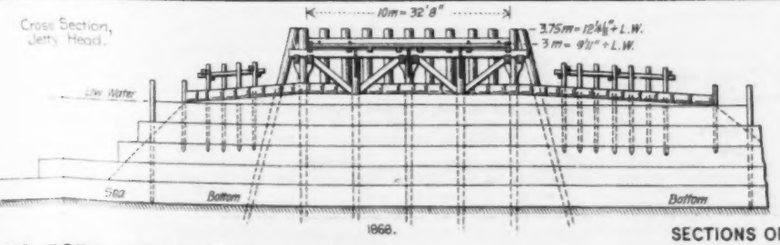
1868.

Section at Sta's.
3771 – 7546 ft.
(1150 – 2300 m.)



1877.

Cross Section,
Jetty Head.



1868.

SECTIONS OF SOUTH JETTY.

TO ROTTERDAM FROM THE SEA.

CHAS. HART & SONS, LITH., 26 VESEY ST., N. Y.

That there are no gases coming from the stack is as I supposed, since there are no foul gases from the driers which can pass the condensers. That no hydrocarbons (gases generated by burning carbonaceous matter) are generated within the driers was evident before these tests were begun, for the temperature within the driers can never rise higher than that of the steam used in the jacket, which by measurement shows a temperature of 325° F., not high enough to volatilize even fatty oils.

The only source of smell, then, must be from the gases of the decomposing garbage, which, having been formed by an aqueous distillation, go back into solution in the water of the condensers with great facility and are carried to the sewer.

To show the nature of the gases which are made when the dried garbage is scorched or burned, samples from many days and different runs were heated in glass tubes and the resulting fumes passed through bulbs containing hydrochloric acid. The white smoke of the generated gases passes through the acid and comes into the air as a visible pungent and strong-smelling gas of a peculiarly irritating nature and a powerful odor very disagreeable in every way. Such gases, did they come from the driers, would pass completely through the scrubbers and be found in the form of dense,white,smoky fumes in the pipes leading to the fireboxes, where doubtless they would be consumed.

We may then dismiss, once for all, the idea that there are any burnt products or hydrocarbon gases generated in this steam-drying process. Our conclusion is then as follows:

(1) That the foul odors and gases from the driers—consisting as they may of the products of decomposition—are wholly taken up and dissolved by the water in the condensers, and that the faint yeast-like odor is the only one that passes beyond the condensers into the fireboxes of the furnace.

(2) That there are no foul hydrocarbon gases or nitrogenous fumes to be burned in the fire, since none of them pass the condensers.

(3) That there are no foul odors in the smokestack and that even the faintly sour, yeast-like smell, above alluded to, is destroyed by the fireboxes before reaching the stack.

(4) That the question of offensive odors issuing from your stack may be finally dismissed, since the smoke from the burning coal, in your case particularly little because of the smoke-consuming device, is the only gas and the only odor which reaches the outer air through the stack.

(5) That you may turn your whole attention to the proper handling of the water from the condensers, which takes off all offensive odors in solution from the driers. This should be conducted to the river by the shortest and most private conduit and at the lowest temperature possible, since it is apt to become offensive when hot.

Concerning the plant at Buffalo, now in operation for a number of years, and near a considerable number of houses of the poorer class, though just outside the city limits, Mr. Ernest Wende, Health Commissioner of that city, writes us:

There is no appreciable nuisance caused by the rendering of garbage in this city.

In relation to the operations of the garbage company at Milwaukee, both as to the collection and treatment of the garbage, very favorable reports have been received. Health Commissioner Dr. Walter Kempster, speaking of the collection and lake transport, says no one is inconvenienced, and regarding the disposal plant he states that "there is very little, if any, odor outside the buildings, and inside the odors are but slight." He also says:

Prior to the establishment of the present plant, the garbage was disposed of in a variety of ways; some of it was taken by farmers into the surrounding country, some of it was thrown into the river and some into the lake; in fact, there was no systematic method of treating garbage until the present was commenced as above stated. It has been in use for about two years, and has satisfactorily disposed of a question which prior to that time gave us no little trouble.

Mr. Gross, President of the Wisconsin Rendering Co., states that not a single complaint has been received to the effect that the rendering plant is a nuisance.

From Detroit Dr. Joseph Schulte, acting Health Officer, writes us as follows:

As regards the works being a nuisance, we could not state, as they are located 20 miles outside the city limits; but we have received no complaints on that score.

Previous to adopting the so-called Merz system, the garbage was cremated, which was an intolerable nuisance.

It will be remembered that two furnaces were tried at Milwaukee and abandoned, but that a Merz plant was also shut down there. Unfavorable location had much to do with the closing of the furnaces and of the early Merz plant, and it is quite likely that faulty construction and operation played its part in both cases. Doubtless all these factors also had their influence in closing the Detroit crematory. The facts are, that so long as garbage disposal plants are located near residences complaints may be expected, no matter what methods are employed nor how well the plants are conducted. The complaints may be unjustifiable, except in so far as no one likes to have the refuse of a city concentrated near his home, even if he knows it can never harm him or his nor offend the senses of sight, smell or hearing.

The references to the crematories and the following remarks have been made largely to emphasize the fact that often complaints against some particular method of garbage disposal would be just as applicable to any other method, and that the Merz system of garbage disposal may, with propriety, be located as near to residences as any other system, so far as can be decided from the facts at hand.

Cost of Treatment.

Next to the sanitary aspects of any method of treating garbage is its cost. The cost per ton for treating the garbage of each of the four cities can be given only approximately, as it varies with the amount of garbage treated. Detroit pays a lump sum for collection and disposal, and, therefore, the cost of treatment alone cannot be given. St. Louis pays $1.80 a ton up to an average of 100 tons, any excess being treated free. Heretofore this average amount does not appear to have been exceeded, so the cost may be taken as $1.80 a ton in St. Louis, thus far, with a probable reduction for succeeding years. Buffalo, for the year ending June 30, 1894, paid about $2 a ton, and Milwaukee, for the calendar year, 1893, about $1.90 a ton. All these figures are for the cost of treatment after delivery to the works. In 1893 it cost Milwaukee about 70 cts. a ton for the transportation of the garbage from the city to the factory, but a lump sum of $10,000 a year is paid for this service. The cost per ton will decrease as the quantity increases.

It thus appears that those who have developed the Merz system have succeeded in establishing a method of garbage disposal which can handle garbage at a cost not onerous to the city, in a manner not objectionable on sanitary grounds, and, withal, at a fair profit to the company operating the plant. Of course, it will be understood that this process could be operated by a city, instead of a company, in case it was so desired. It seems almost marvelous to think that this single modern process of garbage disposal is already treating over 160,000,000 lbs., or 80,000 tons a year, in four cities of the United States, one city alone having two factories capable of treating 300 tons a day, when only a few years ago only the crudest methods of disposal were in vogue anywhere in this country.

THE NEW WATERWAY TO ROTTERDAM.*

By W. Gustav Triest, Jun. Am. Soc. C. E.

(With inset.)

Rotterdam is built on the banks of the "Nieuwe Maas," or New Maas, one of a remarkable system of outlets by which the waters of the Rhine, the Meuse and the Scheldt unite and discharge into the North Sea. The ancient arm of the Rhine, which alone, through the Netherlands, bears the name of the Rhine, has long since ceased to be an outlet of the river waters, being closed by guard locks. The main body of the Rhine flows by Rotterdam under the name of the New or "Nieuwe" Maas. The natural mouth of the Maas, entering the sea at Brielle, had a sufficient depth until the beginning of this century, so that even the deepest vessels of that time could ascend it as far as Rotterdam. There appears to have been at that time a greater depth on its bar than now. It still accommodates ships drawing not more than 10 to 11½ ft., but with strong westerly winds the sea runs so heavy upon the entrance bar that the passage becomes impracticable. Access for vessels of larger draft had to be sought by way of the distant harbors of Brouwershaven or Goeree and through intricate, shoal-beset channels. Owing to the unsatisfactory character of the natural routes of navigation, between 1827 and 1829 a canal was dug through the island of Voorne from Hellevoetsluis to Nieuwesluis. This canal is about 8 miles long, has locks at each end, and affords passage at any tide to vessels of 230 ft. length, 45 ft. width, and 17 ft. draft. The ordinary surface level corresponds to low water at Hellevoetsluis, but it can be raised 6 ft. above that level. With the increase in the size of ships, the depth of water on the bar and shoals of the Goeree Pass and the restricted length of the canal locks soon became insufficient. Large vessels of great draft entered the Brouwershaven Pass, discharged part of their cargoes into lighters, sometimes outside by the Goeree Pass, but oftener by the interior passage, to Hellevoetsluis and through the Voorne Canal to Rotterdam.

It may here be mentioned that the national hydraulic works of Holland, with the supervision over the river and ocean dykes, is in charge of a permanent board, the "Waterstaat." As organized in 1848, this board consists of two inspectors, five engineers-in-chief of the first class and four of the second, fifteen engineers of the first class and fifteen of the second. After the completion of the Voorne Canal the engineers devised various projects for removing the defects of that route. Mr. Greve, a former chief-engineer of the Waterstaat, proposed a jetty starting from the island of Voorne in a northwesterly direction, then, making an elbow, running parallel to the Goeree shore and terminating in the sea at the line of 16½ ft. depth below low water. This jetty would have been nearly 9 miles long, and would have cost $30,000,000. Mr. Greve and Mr. Conrad, engineer of the Waterstaat, recommended also the construction of a new canal through the western point of the island of Goedereede, connecting the Springers-deep with the Haringvliet. The locks of the Voorne Canal were to be lengthened and the river navigation bettered in various ways.

The question of improving the waterway became so urgent that, in 1857, the government appointed a committee of engineers of the Waterstaat to consider the projects of improvement. By order of the government Mr. Greve made a report in the same year in which he advised improving the entrance of the Nieuwe Maas by a pair of dikes of fascine work, at a cost of $3,000,000. The dikes were to start from either shore, paralleling each other for the greater part of their length and terminating at a depth of 18 ft. below low water. They were to reach to a height of 9 ft. above low water, and their combined length was to be about 11¾ miles. A very similar plan, but contemplating lower and shorter dikes, was proposed about the same time by Mr. P. Caland, who was then engineer of the Waterstaat. A year later Mr. Caland submitted a project which differed considerably from the two above mentioned. Instead of attempting to obtain an outlet through the old mouth, the northern arm of the Nieuwe Maas and the Scheur were to be followed and then extended by a channel cut through the Hoek van Holland, with a dam across the old outlet of the Scheur just above the proposed cut. The plan also contemplated improving the whole river from Krimpen to the new cut by means of lateral dikes which would modify the directions of the currents and correct the channel widths. A cut was to be made through the easterly point of the island of Rozenburg so as to throw the waters of the Old Maas into the Scheur. A uniform depth of 21.3 ft. at low water was to be obtained from Rotterdam to the sea. The great advantage of this last project was mainly that a depth of 18 ft. below low water could be obtained, with jetties of a total length of 8,530 ft. Furthermore, the Scheur branch of the Nieuwe Maas is more regular and better adapted for a great navigable channel than the southerly branch which passes by Brielle.

The Waterstaat made the following criticisms on the above propositions: Mr. Greve's plan for the improvement of the Goeree Pass involved a very great expense, while the desired result could not be regarded as certain. To the Goedereede canal the objection was made that in addition to the admitted inferiority of canal to open river navigation, there existed in the Haringvliet, directly in the route of vessels, a shoal which was doubtful of removal. The objections to the Greve plan for the improvement of the Brielle Pass were as follows: It does not provide for the free admission of the tidal flow, which is mainly influential in maintaining depth in the outlets of rivers; further,

*A paper read before the International Inland Navigation Congress, at The Hague, Holland, 1894. This paper has been compiled from notes and observations of Mr. E. L. Corthell on a visit to the works in 1891, from several articles of the Dutch periodical "Tijdschrift van het Koninklijk Instituut van Ingenieurs," from the "Report on the improvement of navigation from Rotterdam to the sea," by Gen. J. G. Barnard, U. S. Army, 1872, from an article by W. Paul in the "Zeitschrift fuer Bauwesen," 1892, from a paper by A. von Horn, "Der neue Wasserweg von Rotterdam nach See" in the "Zeitschrift des Oesterreichischen Ingenieur-und Architekten Vereines," 1894, from two papers by J. W. Welcker on the "New Waterway," and from the book "Le port de Rotterdam" by J. H. Nelszen. The illustrations have been prepared from the maps of the engineers of the work. The writer takes this opportunity to express his thanks to Mr. E. L. Corthell for the revision of the article.

the jetties are given the height of storm tides, thus increasing the expense and needlessly exposing the work to injury. The construction of the excessively long jetties would be difficult, as they would be built upon the existing shoal on which the breakers are violent during moderately strong westerly winds. The last remarks apply also to the first plan of Mr. Caland, with the qualification that the lesser height diminishes the expense and affords less exposure to injury from wave force. The commissioners adopted Mr. Caland's second plan with some slight modifications, and a law passed in January, 1863, provided for its execution. Thus was to be realized the project of the Dutch engineer, Cruquius, who, in 1739, had proposed to open a shorter outlet to the waters of the New Maas by cutting through the Hoek van Holland. In indorsing the plan the commission presented some "general considerations" on the improvement of navigation into the mouths of tidal rivers. A short abstract of the same follows:

Theory and experience have taught that the most powerful agent in maintaining the depths of the Dutch tidal outlets is to be found in the velocity with which the water moves through the section of the navigable channel. If the velocity and volume of water required cannot be obtained, resort must be had to dredging or to artificial canals.

The incessant action of the tides and waves keeps the sands in constant motion along the Dutch coasts, establishing such a slope that a depth of 18 ft. below low water cannot be found nearer than 2,600 to 4,300 ft. from the shore line. The drainage water of the rivers is quite inadequate to maintain, through this slope, a channel of a depth sufficient for large vessels, owing to the great width of the river mouths. But the tide enters the mouths and, during ebb, is discharged with the accumulated drainage water, than which, however, its volume is many times greater. Hence the maintenance of depth in the Dutch river outlets is principally due to the action of the tides. This action increases with the tidal range. To increase the latter is not within the power of man, but the direction and form of the entrance may be regulated. The outlets of the Dutch rivers in the North Sea all have a curve to the southward whereby they better guide the tidal current which flows from out the channel. The shortest line to the required depth is nearly northwest, because the coast trends northeast; but as the tide-stream comes from the southwest, the direction should lie, at least, east and west.

The volume of rivers grows as they approach the sea. To maintain an equal depth, the width must hence be the greatest at the outlet, diminishing funnel-wise in ascending. For the protection of the outlets externally, jetties must be used. Inland, the width of the rivers is often regulated by jetties of cribwork. For the lower rivers this method is undesirable, as between the cribs there remain basins which the tide must fill, thus diminishing its upward flow. The further the tide reaches, the more powerful will be the ebb, and preference is therefore given to lateral dikes.

The law of 1863 established the width of the tidal stream at 740 ft. at Krimpen, gradually increasing to 1,480 ft. at Vlaardingen and to 2,960 ft. at the sea end of the jetties. These widths were fixed on the assumption that, owing to the removal of the existing contractions, particularly those at Rotterdam and Charlois, the tide would ascend higher and need larger cross sections. Such are required also between Rotterdam and Krimpen to relieve the flow of the Lek. For the heights of the lateral dikes the mean between high and low water was taken; a greater height would diminish the quantity of tide-water, while a less height would decrease the effects of the ebb currents. The following sections of the dikes from Krimpen to the Hoek were determined upon, as far as they are not a part of the shores themselves. The top width is 10 ft., with slopes on the river side 1 to 1, on the land side ½ to 1. The landward berms are 6½ ft. wide, while the berms on the river side are 16 ft. at Krimpen, increased to 48 ft. at the outlet. Along the cut through the Hoek and connecting with the "downs" high dikes on each side were planned with the double object of making suitable connections with the sea jetties and providing areas of land protected from overflow, where men and goods would be in security during storm-tides. The two sea jetties were to consist of fascine work with stone. The new cut was calculated at a width of 164 ft. and a depth of 10 ft. at low water in the expectancy that the river, after the damming of its old outlet, would scour a bed of sufficient depth and width. The cost of the whole improvement was estimated at only $2,500,000, the work to be completed in six years. The construction of the north jetty was begun in 1863 and finished in 1874, while the south jetty was started in 1864 and completed in 1876.

The Construction of the Jetties.

The length of the northern jetty is 6,560 ft., while the south jetty is 7,550 ft. long. The jetties begin at the high dikes on the shore above mentioned, at an elevation of 3 ft. 3 ins. above mean high water at the high water shore line. They are well connected with these dikes, so that the water cannot scour behind them and tear them off. From the shore their top descends in an easy curve to a height of about 3 ft. 3 ins. above low water. The ordinary tidal range is 5 ft. 7 ins., more or less.

The jetties consist of mattresses of fascine work covered with stone, of the dimensions given by the drawings. Their top is curved 20 ins. and paved with large blocks. They were constructed on the sea-beach between high and low water, so that after completion they could be floated off at high tide. They were towed to their location and anchored with sinking lines, then loaded with stone and sunk to the bottom. The mattresses were loaded with at least half a ton of stone per cu. yd. of fascine work. The mattresses consisted, in the first place, of a grillage of fascines, the bottom layer of which lies crosswise at distances of 36 to 40 ins. between centres. The fascines were 4 to 6 ins. in diameter and were composed of small branches of willow trees. The upper layer of fascines crosses the first one at right angles; they are laid not more than 36 ins. c. to c., and are made as long as possible, as longitudinal strength is needed. Where jointed they are spliced by short fascines bound to them, or they are united by cutting open the end binding-withes and interlocking and binding the ends together for a length of 5 to 6½ ft. The two layers are connected at the intersections with flexible withes, while along the circumference and at alternate inside joints they are bound together with tarred ropes. These ropes are cast around stakes so that they can, after the filling up of the mattresses, be made fast to the upper grillage. Upon and perpendicular to the bottom layer are then placed loose layers or bundles of osier willow, in which the longitudinal fascines are thus embedded. A second layer, called the filling layer, is put crosswise. Over this filling layer are placed the longitudinal fascines of the upper grillage, between which is put down a second filling layer. A final cross layer of fascines is then so laid that their intersections with the longitudinal fascines coincide with those of the lower grillage, which are marked by the above-mentioned stakes. These intersections are bound with the same cords, so that the osier filling is compressed as tightly as possible between the two grillages. The other intersections are stiffly bound with withes. The stakes are then withdrawn. The three layers make a mattress 16 to 24 ins. thick. The upper surface of the mattresses is provided with enclosures of hurdle work in order to keep the ballast in place should the bottom be sloping. The size of the mattresses depends on the convenience of transportation and of sinking; they should contain not less than 480 sq. yds. The largest mattresses sunk have a breadth of about 50 ft. and a length of from 490 to 590 ft. Above low water the fascine work is laid in separate fascines by hand. These, like the mattresses, are loaded with stone.

The jetties are consolidated by oak piles, 30 to 38 ft. long, which are driven through all the layers into the bottom. The tops of these are framed together, thus forming the supports of a platform on which a track was laid during construction. The foreshore berms and slopes surrounding the pier head are further secured by three rows of oak piles framed together as shown on the drawing, Fig. 5.

As soon as a portion of the jetty was completed to above low tide, ballast stone was thrown in upon the base berms and sides to an amount of 56 to 64 tons per lin. yd. of jetty. No stone of less than 110 lbs. weight was used, and above low water they were carefully laid and their joints packed with smaller stones, spawls and quarry refuse. Between the piles around the fore-shore berm of the pier head, stones were placed weighing at least half a ton, and on the outside of the outer row of piles of that berm at least one row of stones was deposited of a minimum weight of one ton.

No artificial stone has ever been used on these jetties. The largest natural stone weighed only about 1½ tons. The secret of the success in maintenance has been that the jetties have been kept low enough to allow the storm waves of high tides to go over them, and that the most exposed slopes have been protected by flat stone of good dimensions placed over each other like shingles on the roof of a building; the lines of shingling being laid at right angles to the direction of the sea as it strikes the slopes of the jetties. A railroad track extends the entire length of the jetties, the rails being laid on longitudinal timbers embedded in the stonework, and above this stonework rising above the tops of the rails on either side between the tracks so as to protect it from the waves. The annual cost of keeping the jetties in repair is but $7,200, a proof that it is feasible to maintain such works in an exposed situation.

Construction of the New Waterway.

Simultaneously with the construction of the jetties the damming of the Scheur was begun and carried up to high water in 1872. The profile of the dam, as designed, had to be greatly altered during construction. The total width of the Scheur at the location of the dam was about 1,000 ft. This outlet could not be stopped before the new channel was cut through the Hoek. While this latter work was going on, jetties were built out from the embankments of either shore contracting the channel to 420 ft. and confining it to the deepest existing portion. Between the ends of these jetties a bottom revetment of fascine work and ballast stone was sunk to prevent the accelerated tidal currents from scouring the bottom of this opening. Later it was found that the bottom along the edges of the revetment had greatly deepened, undermining them and letting it extend across the river like a ridge. The subsequent construction of the dam was thereby rendered more difficult, as the regular process of sinking mattresses could be applied only after the great inequalities of the bottom had been levelled up by laying successive small mattresses.

The contracts for the construction of the channel through the Hoek were awarded in March, 1863, but as acquiring the right of way occupied much time, actual work on the excavation was not begun until 1866. In the years to 1868 a canal of a bottom width of 33 ft. and of a depth of 6½ ft. below low water was excavated through the Hoek. Thus a new outlet of the Scheur into the sea was created. The canal was enlarged to a width of 164 ft. in 1870, and after the old mouth had been closed the river began to actively scour out its new bed. The current is said to have carried away not less than 6½ million cubic yards of material in one year. The new waterway was opened to navigation in 1871, though the required width and depth had not yet been attained. On July 10 of that year two fishing boats passed through the cut as the first vessels; they were followed in March, 1872, by a steamer of 10 ft. draft.

A few years were now spent in seeing how the new cut would develop, but it soon became evident that, under the existing conditions, the scouring force of the current alone would not create a channel of sufficient dimensions. A great part of the scoured material had settled between the jetties. This is explained by the fact that the narrow sections of the cut, of a width of about 820 ft. suddenly changed there to 2,950 ft. Over $5,000,000 had been expended on the cut, the jetties and the regulation of the river, without attaining the desired end.

A careful survey, made in April, 1877, showed the situation as follows: In the new cut there had formed a narrow channel of more than 23 ft. depth to within about 4,000 ft. from the jetty heads; but through the bar between the latter there was a channel, near the north jetty, of only 15½ ft. at high water, thus prohibiting large vessels from entering.

The project of the commission of 1858 had counted on the action of the sea currents to widen and deepen the waterway between and in front of the jetties as well as inside of the cut, but it now became apparent that it would be necessary to assist nature or the whole enterprise would collapse. Consequently, in May, 1877, a law was enacted which required the bar between the jetty heads to be removed by dredging. The government did not rest contented with this measure, as experience taught that an artificial channel through the bar shoaled again very rapidly. It appointed a committee which should examine the original project and report on the necessary changes so as to ensure the success of the undertaking. The committee made a preliminary report in 1878 and submitted a definite project two years later. The essential features of the plan were retained, but some changes were recommended, especially with regard to the standard widths, the improvements at the eastern point of Rozenburg and the jetties. The commissioners further proposed a different method of execution, abandoning the principle that a channel could be developed by the natural force of the current, and advising to place reliance solely on artificial means. The following standard widths were recommended: 820 ft. at Krimpen, 1,110 ft. at Rotterdam, 1,470 ft. at Vlaardingen, 1,740 ft. at Maassluis, 2,060 and 2,160 ft. at the beginning and end of the cut respectively. The width was to be 2,250 ft. at the existing sea end and 50 ft. more at the proposed sea end of the north jetty, which was to be lengthened. The above widths exceed the previous ones above Vlaardingen and are less below it.

The old Maas and Scheur were to be separated by a dam which should reach from the dikes of the eastern point of Rozenburg across to those of the island of Ysselmonde, communication between the two rivers to be had by means of a lock in the dam. The commission finally proposed to extend the existing jetties to a depth of 29½ ft. at low water and to raise them to 13 ft. above low water by means of concrete blocks on a foundation of basalt rocks. In order to reduce the width between the existing jetties from 2,950 ft. to 2,290 ft., the construction of a pair of low dams of fascine work about parallel and between the old jetties was suggested. The crown of these dams should be at the elevation of low water. A lengthening of the jetty was considered necessary, as it was the opinion of the

commission that between and in front of the existing jetties the required depth at low water for ships of 21-ft. draft could not be obtained; the sea currents landwards of the 28-ft. depth line would not be powerful enough to remove the sand which was carried out by the tidal stream.

The cost of execution of the new plan, including the regulation of the Maas up to Krimpen, was estimated at $12,000,000. The city of Rotterdam promised to contribute 10% of this sum, up to a maximum amount of $1,200,000. The report of the commission was submitted by the government to the "Generalstaaten," the legislative body, but it never came up for discussion. The excessive cost formed a great obstacle, especially as nearly $4,000,000 had already been spent up to the end of 1880. Moreover, the success of the improvement was greatly doubted. The government declared it indispensable that the dredging of the cut be energetically pushed, and in 1881 the appropriations were made for dredging the cut and building the inner south jetty. The method of annually appropriating sums for executing single parts of the project of the commission without the plan having been adopted and without the government pledging itself to carry it out, was vigorously opposed in the Upper Chamber. The government then decided to complete the work for a maximum sum of $6,000,000, omitting the lengthening or raising of the jetties and not bringing the river between Rotterdam and Krimpen to a continuous channel depth of 21 ft. at low water. The Upper Chamber appropriated this sum under condition that each year not more than $600,000 should be expended; and the last of the appropriations was expended in 1893.

In the mean time the conditions at the mouth had changed considerably. In 1877 a contract was made for excavating 6,760,000 cu. yds. in the cut and 915,000 cu. yds. on the bar between the jetty heads. This work was pushed vigorously. In dredging the bar it was the intention to divert the ebb current from the right-hand shore and bring it to bear against the bar midway between the jetties. The result was that a deep channel, the so-called "West Channel," formed near the south jetty. Where in 1877 there was only a depth of 6½ ft. at low water, in 1880 it was 10½ ft. deep, so that the new channel could be opened to navigation. The contraction of the width between the jetty heads to 2,300 ft. by the inside south jetty and extensive dredging operations succeeded, by the fall of 1883, in creating a channel between the jetties with depths varying from 15 to 20 ft. In the spring of the following year a continuous depth of 18 ft. at low water was attained. This depth has since increased steadily. In 1887 the least depth between Maassluis and the Hoek was 25½ ft. at high water, while the 18-ft. channel was nowhere less than 430 ft. in width. The soundings of October, 1889, give 27 ft. 7 ins. as the least depth between the North Sea and Maassluis and 26 ft. 11 ins. between the latter place and Rotterdam. Since March, 1890, navigation finds a minimum depth of 28¼ ft. at high water with a width of 430 ft. at that depth. The map of soundings of June, 1891, gives in the line of the "range lights" a least depth of 31½ ft., and that of August, 1893, gives even a little more. This result has been accomplished without lengthening or raising the jetties, showing that the fears of the commission that otherwise a bar would form in front of the jetties were groundless. There is no trace of a bar in the sea at present. Nearly all vessels of deep draft enter at flood tide and, ascending the river with it, reach Rotterdam within two hours. Deducting from the available channel depth at high water 20 ins. in summer and 32 ins. in winter for keel-water and for sea-swells, leaves a safe entrance in summer for vessels of 30-ft. draft and in winter for 29 ft.

The principal measures which, since 1877, have contributed to the rapid and lasting improvement of the waterway are:

1. The dredging of the cut. According to the map of 1889 the cut had been dredged to its full normal width, as urgently recommended by the commission in order to carry the flood tide inward as rapidly and as far as possible. The great influence of this work is seen from the fact that in 1882 there existed at the upper end of the cut a least depth of only 16 ft. at low water which had increased to 23¼ ft. in 1889.

2. The narrowing of the "Noordgeul," as the river arm is called which branches off at the eastern point of Rozenburg, below Vlaardingen. The interests of navigation compelled the modification of the plan to dam this branch entirely and to have a lock through it only. Instead of that the Noordgeul was very much reduced in width between 1885 and 1887. It is now only 230 ft. wide against an original width of 1,060 ft. As a result the movement of the tidal stream has become much more regular and nearly all the water of the New Maas and its ebb tide volume flows along the Scheur and out to the sea through the new cut. The favorable effects of this show themselves in the Scheur down to the outlet.

3. The removal of the shoal in the Scheur between Vlaardingen and Maassluis. A little below the Noordgeul there existed a very persistent shoal which had acquired notoriety in the history of the waterway. The map of 1882 shows the channel interrupted there and giving a depth of only 18 ft. at low water. This depth had increased by about 3½ ft. in 1889; periodical dredging is still necessary.

4. The dredging of the bar "Het Zuiden." About 3.7 miles below Maassluis where the channel changes from the right to the left shore, a bar has always existed which has been deepened by the general improvement of the waterway. Where there was a depth of 16¾ ft. at low water in 1882, it had increased to 19½ ft. in 1889, and varies now between 19 and 20 ft. at low water or 24½ and 25½ ft. at high water. Since the amelioration of the outlet this bar has become the limiting factor in the capacity of the waterway. A sufficient depth over it can only be maintained by continuous dredging. The channel here persistently maintains its former direction towards the old outlet of the Scheur, though this has been closed for a number of years.

Besides the above principal measures, two important works may be mentioned. These are restricting the width of the Scheur above and below Maassluis. This work formed part of the original project and was indorsed by the commission with some alterations. It was nearly completed in 1887 at a cost of about $700,000. Further the dredging of "het Beneden-Scheur." As this had a less width above the dam across the Scheur than the closed mouth, it has been enlarged up to the point below Maassluis. Both shores are revetted and, where necessary, built out to the standard width. The dredged material was dumped into the New Maas and for its transportation a canal with locks was built through the lower end of Rozenburg. This canal also forms a navigation channel between the new waterway and the Brielle New Maas.

From the beginning of the improvement in 1863 to the close of 1893, there was expended in construction, exclusive of maintenance, $14,765,300. The exact amounts from 1889 to 1893 have not been available in writing this paper, and the maximum annual proportions are used. The yearly cost of maintenance of the outlet by dredging was, according to official reports of October, 1893, $16,000 between the jetties and $32,000 in the sea beyond the north jetty.

This very important work has been successfully completed. The good results have been attained by extensive dredging operations and a skilful utilization of the scouring force of the ebb tide. A very interesting problem has thus found a solution. The problem is, on what principles must the improvement of the outlets of tidal streams be carried out, where the tidal range is small and the outlets are exposed to the depositing action of the sea, and where the tidal current becomes the principal agent and dredging operations are of secondary importance. Under such natural conditions a fan-shaped enlargement has been generally recommended in order to freely admit the flood tide. This principle was followed here at first, but was abandoned later when it was found that the force of the current, weakened by the wide sections, could neither create nor maintain the required depth.

The Maas belongs to that class of tidal streams which drain a considerable area, but have a small tidal range so that the formation of bars at the mouth can only be removed and afterwards prevented by increasing the natural current at ebb tide. Now, if on the one hand a wide mouth cannot be dispensed with, and if on the other hand the ensuing disadvantage of weakening the ebb current must be avoided by narrowing the outlet, both requirements can be satisfied only by a double profile. The larger high water section will serve the former and the low water section the latter purpose. The necessity for reinforcing the ebb current becomes more urgent as the shoaling at the mouth is caused not only by the sand which is carried down the river, but also by the sand which in stormy weather is carried in with the flood tide. The latter sand will settle after the storm has subsided and will create shoals. To remove these, dredging operations would, as experience teaches, not only be insufficient, but would be impracticable in heavy weather.

The uniform waterway, gradually widening towards the sea, has exerted a most beneficial influence in carrying off the ice. Throughout the severe winter of 1890-91 Rotterdam remained accessible to steamers and sailing vessels, while most ports of Northwestern Europe were closed by ice.

Dredges Used on the Work.

The dredging operations before 1882 deserve slight mention, as the difficulties until that time were not as great as later on. The north channel was dredged under the protection of the north jetty, so that even ordinary bucket dredges had a sufficient number of working days. In dredging this channel the principal object was to render nagivation possible, reserving until later the deepening of the main channel. The conditions changed in 1882. The "West Channel" from its location midway between the jetty heads, was exposed to heavy seas, and to all winds from west-southwest to northeast, and it was further desirable to attain the proposed depth in the shortest time possible. Within 18 months from April, 1882, 522,000 cu. yds. were to be dredged, making a monthly average of 29,000 cu. yds.; while, according to previous experience, only a very limited number of working days could be counted on. The former suction dredges could work in a maximum wave height of 26 ins., while it was now necessary to operate them in a wave height of 32 ins. Among the existing types of dredges could be considered only a self-loading bucket dredge, Priestman's grapple dredge, the hydraulic dredge by Bruce and Batho, and the centrifugal pump dredges.

The ordinary bucket dredge could only be used in a wave height of 12 ins. It occupied much room in the channel with its dumping barges, and it must retreat to a place of safety in bad weather. To arrange a bucket dredge self-loading would be very expensive on account of the large amount of machinery required. Trials with the Priestman dredge in 1881 showed it was not adapted to the material to be dredged. Experiments with other dredges were not made, as centrifugal pump dredges had already proved themselves satisfactory, and it was expected that their efficiency could be still further increased. The principle of the centrifugal pump dredges is that the mouth of a tube which is suspended from a ship, is placed near the bottom of the sea or river. Through this tube a centrifugal pump on the vessel lifts the sand with the water and discharges it into the hold of the vessel, which transports it to deep water at sea and dumps it there, or separate barges are used for taking away the dredged material. The first pump dredge for this work, "Adam I.," was designed by the English engineer, Dorlon Hutton, and built at Dordrecht. It had two suction tubes which operated in two wells in the longitudinal axis of the ship; it was not self-loading. A second larger self-loading dredge, "Adam II.," of the same type, was built soon afterwards. It was 110 ft. by 26 ft. and 10½ ft. from keel to deck. The single suction pipe worked through a longitudinal well. On deck the pipe splits into two branches which lead into the two loading chambers, one of which is placed on either side of the well. The two chambers have a joint capacity of 180 cu. yds. "Adam II." made four double trips daily, removing on an average about 720 cu. yds. per day. In 1880 another dredge, "Adam III.," was built on the same plan, but of larger dimensions, at a total cost of $18,000. With a draft of 11½ ft. when loaded it could carry 276 cu. yds. It made three trips daily, carrying away a total of 830 cu. yds. Several more dredges were then built of this class, but with some improvements. The suction pipe, for instance, was placed outside of the vessel, thus giving one continuous loading chamber. Two of this kind of dredges were built, with a capacity of 320 and 208 cu yds., respectively. Recently dredges of 680 cu. yds. capacity have been used. A combination dredge is also in use, the suction pipe working on the side of the vessel and an ordinary endless chain bucket dredge working in an opening in the center of the vessel. This is especiaHy adapted to varying kinds of material, but it requires complicated and expensive machinery to thus unite the two methods.

The Port of Rotterdam and its Commerce.

It may be stated for information at the outset that the city of Rotterdam, including Delftshaven, which was taken into the city in 1886, has a population of about 300,000. The development, enlargement and maintenance of its port are in charge of the city, which has in this work, including all bridges, dikes, wharves, etc., expended about $5,000,000 between 1874-1888. The state also has expended a somewhat larger sum in developing railroad facilities.

The port of Rotterdam comprises the waters of the New Maas inside of the city limits, the basins below the city on the right bank, and the new basins on the left bank. All basins, excepting those of Delftshaven, are open freely to the river. The average tidal range at the city is 46¼ ins. The Delftshaven basins are closed by a lock, the gates of which remain open at ordinary tides. Among the various recent works of improvement in the harbor are levees along the left bank on lines laid out by the commission, and a basin on the left bank called the Rhine Harbor Basin. The construction of this basin became necessary for the protection of the Rhine boats which winter at Rotterdam. All the levees are built in deep water, and with a steep slope on the river side, so that even deep draft vessels can come close to the shore. Sea walls may be built later to occupy the place of the present levees. In 1847 Rotterdam had about 65 acres of basin area, and a wharf frontage of 6 miles. In 1887 it had 172 acres of basin area, and 12¼ miles of wharf frontage. The city is a free port for merchandise in transit. On the left bank, below the city, there are rocks for petroleum.

The beneficial effects of the new waterway can be readily seen from the changing methods of navigation, and the reduction in transportation charges which en-

sued. The distances from the sea to Rotterdam and intermediate points are as follows:

From sea to Maassluis	9.3 miles
" " " Vlaardingen	14.3 "
" " " Schiedam	16.8 "
" " " Rotterdam	21.1 "

By the old waterways the distances were:

From Brouwershaven to Rotterdam via Hellevoetsluis	63 miles
From Zieriksee to Rotterdam via Hellevoetsluis	65 miles

The voyage from Rotterdam to the sea, or vice versa, can be made by the new waterway in from two to three hours, while it formerly required from two to five days. For vessels of about 23 ft. draft or more, that cannot make the trip in one tide, a mooring place has been provided near the eastern point of Rozenburg. Provision has also been made there for ships to take on more cargo in going to sea. The change in methods and transportation may be seen from the fact that the tolls on the Voorne Canal, which amounted to $42,000 in 1873, dropped to $43 in 1886; and in addition the larger vessels had to discharge part of their cargo at Brouwershaven or Hellevoetsluis. The following abstract from the tariff of the tug company of L. Smit & Co., October, 1889, gives the prices for towage by the new and old waterways:

By the Old Waterways.

	300 tons and less.	Per ton.
From Brouwershaven, innerway, to Rotterdam	$88.66	$0.145
From Brouwershaven, outerway, to Rotterdam	97.52	.161
From Hellevoetsluis to Rotterdam.	34.66	.064

By the New Waterway.

	Summer. 100 tons and less.	Summer. Per ton.	Winter. 100 tons and less.	Winter. Per ton.
From Rotterdam to the sea, in one tide	$24.18	$0.048	$31.43	$0.064
From the sea to Rotterdam	30.22	.072	39.49	.097

Note.—The "tons" are registered tons of 3.7 cu. yds. (2.83 cu. m.) each.

The number of vessels which use the new waterway and their draft has been growing with the increase in depth in the channel.

PERSONALS.

Mr. Ebenezer Berry, Jr., Street Commissioner of Bayonne, N. J., died Oct. 24.

Mr. William H. Haydock has resigned his position as Superintendent of the Coast Division of the Southern Pacific Ry.

Mr. Joseph P. Card, Assoc. Am. Soc. C. E., President of the Chicago Tie Preserving Co., died at Englewood, Ill., Oct. 22.

Mr. John Edgar Thompson, a civil engineer in the employ of Drake & Stratton, died at Allegheny, Pa., Oct. 25, at the age of 24.

Mr. T. W. Whisnant, Division Superintendent of the Seaboard Air Line has been appointed Superintendent of Roadway of the entire system.

Mr. Frederick Law Olmsted has been appointed by the New York Park Commissioners as landscape architect for the Harlem River speedway.

Mr. Frederic Danforth, M. Am. Soc. C. E., of Gardiner, Me., has been appointed by Gov. Cleaves a member of the State Railroad Commission of Maine.

Mr. J. D. Bradford has been appointed Superintendent of the Choctaw, Oklahoma & Gulf Ry. Mr. Francis I. Gowen, of Philadelphia, is President and General Manager.

Capt. Robert B. Pegram, formerly of the U. S. Navy, died at Norfolk, Va., Oct. 24, at the age of 83. After the war he was for some time Superintendent of the Petersburg & Weldon R. R.

Mr. Edward C. Munson, contractor, died at Portland, Me., recently. He was identified with the construction of many public works in the vicinity of Boston, and built many of the abutments of the Boston & Albany R. R. bridges near that city. With his father he completed the Hoosac Tunnel.

Mr. E. M. Benson, of Colfax, Ill., who died at Ames, Ia., Oct. 9, at the age of 29, was a member of the class of 1890, University of Illinois. He spent three years as transitman in the West, two on the Coeur d'Alene branch of the Northern Pacific R. R., and one in British Columbia on the Spokane Falls & Northern R. R.

Mr. Rudolf Wieser, of New York city, has been appointed General Agent of the Nicaragua Maritime Canal Co., with headquarters at Managua, and sailed for Nicaragua on Oct. 20. Mr. Wieser is an engineer and contractor of wide experience, and has been engaged on important public works in the United States, Mexico and Brazil.

Col. Garrick Mallery, U. S. A., who died at Washington, D. C., Oct. 24, at the age of 64, was in 1876 appointed to service under Major Powell on the geological and geographical survey of the Rocky Mountain region, owing to his special study of Indian languages, history and mythology. He was retired in 1879 on account of injuries received during the Civil War, and accepted an appointment as ethnologist in the Bureau of Ethnology. He was at one time Vice-President of the American Association for the Advancement of Science.

Mr. Charles M. Jarvis, President and Chief Engineer of the Berlin Bridge Company, of East Berlin, Conn., returned from Europe this week, after an extended tour among the bridge-building establishments of England and the Continent. He was especially impressed in his visits with the time consumed in turning out structural work in these establishments, and declares that more bridge-work can be done by an American bridge shop in 60 days than could be accomplished in six months with the plant and workmen of the average European constructor.

Mr. Charles Carpmael, F. R. A. S., F. R. S. C., director of the magnetic observatory, Toronto, and director of the meteorological service of Canada, died in the south of France recently, at the age of 48. He was born at Streatham Hill, England, Sept. 17, 1846, and was educated at Cambridge. In 1870 he was a member of the British "Eclipse" expedition to Spain. In October, 1872, he was appointed deputy superintendent of the meteorological service of Canada, and director of the magnetic observatory and superintendent of the meteorological service in February, 1880. He was attached to the observatory at Toronto.

Mr. D. W. Caldwell, elected President of the Lake Shore & Michigan Southern R. R., to succeed the late John Newell, was a civil engineer in the service of the Pennsylvania R. R. Company in 1852. He was later Superintendent of the Pittsburg & Connellsville R. R. from 1855 to 1859, and for the next ten years was Superintendent of the Ohio Central R. R. From 1869 to 1874 he was General Manager of the Columbus, Chicago & Indiana Central R. R., and from 1874 to 1881, he was General Manager of various lines in the Pennsylvania Company's Western system. In 1881 he became General Manager of all the Pennsylvania lines west of Pittsburg, and was made Vice-President of the "Nickel Plate" system in 1882. He also served as receiver of the latter road from 1885 to 1887, and on Oct. 1, 1887, he was made President of the reorganized company and still holds that position. Mr. Caldwell was born in Massachusetts in 1830.

NEW PUBLICATION.

PRACTICAL HYDRAULIC FORMULAE, for the Distribution of Water Through Long Pipes. Also Notes on Water Supply Engineering. 2d Edition. By E. Sherman Gould, M. Am. Soc. C. E. Engineering News Publishing Company. 8vo; cloth; pp. 105; illustrated; $1.50.

This second edition of Mr. Gould's practical treatise is entirely new, in type and illustrations, with the mathematical part carefully revised and some errors of the press in the first edition corrected. The author's long experience in hydraulic engineering has enabled him to lay down in a concise and simple manner the principles governing the flow and distribution of water in long pipes under many conditions, and he illustrates his discussion by practical examples fully worked out. His method of treatment is very clear and cannot be misunderstood. From the same experience and in the same practical manner Mr. Gould gives notes on the methods of pipelaying, and under this head contributes many useful hints. To this edition he adds several new chapters, covering about one-third of the contents of the present edition, relating to the quality and quantity of water obtainable, and to masonry dams. Under the first two heads much useful advice is given, and in the chapter on dams the author takes up step by step the various sections of low masonry dams, and works them out, carefully noting their weak and strong features. He closes his discussion of dams with practical suggestions as to the materials to be used, outlet pipes, disposal of springs, etc. The whole work is eminently what it claims to be, a very practical discussion of the underlying principles of hydraulic construction, concisely and clearly expressed, accompanied by useful hints gathered from an experience of 17 years in water-works design and construction.

SOCIETY PROCEEDINGS.

NEW ENGLAND RAILROAD CLUB.—At the October meeting papers were read on the ventilation of passenger cars by Messrs. J. M. Palmer and W. G. Creamer. Copies of the papers can be obtained from Mr. F. M. Curtis, Secy., Box 1576, Boston. At the November meeting, to be held on Nov. 14, Mr. W. W. Snow, of the Ramapo Wheel & Foundry Co., will read a paper describing experiences in Norway and Sweden.

MASTER CAR BUILDERS' ASSOCIATION AND AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.—The joint committee on place of meeting of these two associations has decided on Thousand Islands, Alexandria Bay, N. Y., as the place for holding the conventions of June, 1895. Accommodations for the members will be furnished by the "Thousand Island House" and the "Crossman House." Those purposing to attend the convention are advised to engage rooms at once, as rooms will be assigned in the order in which applications are received. The Master Car Builders will begin their sessions on Tuesday, June 11, 1895, and the Master Mechanics will meet on the following Monday.

ENGINEERS' CLUB OF CINCINNATI.—At the September meeting Mr. Geo. T. Waite read a paper on "The Progress of Electric Traction," in which he reviewed the progress from the application by Frank J. Sprague of electricity to the Richmond, Va., street railway in 1887 to the present widely-extended application of electric traction.

At the October meeting a paper by Mr. John W. Hill was read, under the title, "Shall Our Drinking Water be Sterilized?" in which he called attention to various epidemics of typhoid fever that were traceable for their origin to the impure water furnished to the communities in which they occurred. To avoid this he advocated the furnishing, for domestic purposes, of water purified by filtration and distillation, in a plant established for that purpose; such water to be supplied through a system of street mains independent of those supplying water for other uses. The cost of providing and operating a plant of this kind to supply a population of 400,000 he estimated approximately would not exceed $1 per capita per annum. The paper also contained an account of the results of some tests of drinking water, both filtered and unfiltered, made by the writer.

ENGINEERS' CLUB OF PHILADELPHIA.—At the meeting on Oct. 20, Prof. Silas G. Comfort read a paper on "Unit Stresses for Railway Bridges of Wrought Iron." The author concluded by stating that the data which he had collected emphasized the fact that a simple statement of the factor of safety required furnished but little information, unless the ultimate strength and the unit stresses to be used in obtaining it were known. The paper was discussed by Messrs. Cummings, Furber, Davis, Webster and Schumann. Mr. A. L. Eltonhead's paper on "The Electro-Metallurgy of Gold and Silver," originally presented May 5, was read with some additional matter. He cited numerous instances in which the metals sodium, potassium and ammonium, gold and silver, had been separated previous to 1840, but stated that it was not until recent years that the ideas then advanced were put into practical shape and successful operation. In the electro-chemical process described by the author in his paper of May 5, 1894, the ideas of Sir Humphrey Davy and Mr. John Bright were partially utilized in making sodium and potassium amalgams by the electric current, and the dissolving of metals with the cyanides; but the construction of the precipitating "box" used in the described process, whereby the gold and silver alone may be perfectly extracted from an old plating solution of cyanide, or from a cyanide solution leached from gold and silver ores, is new. The possibilities of the electro-chemical process seem unlimited, as the precipitating "box" may be used to extract gold and silver from the ores direct, or from other solutions than the cyanides mentioned in the paper.

L. F. Rondinella, Secy.

CENTRAL RAILWAY CLUB.—At the meeting at Buffalo on Oct. 24 the discussion on Mr. Morford's paper on "Terminal Yards" was postponed until the next meeting, which will be held in January. The following is an abstract of the report presented by Mr. McIlwain for the committee on "Car door hangers, fastenings, hinges, brackets, practical results from common devices, etc.":

A great improvement was made when the door track was moved to the top, with hook-shaped hangers attached to the top of the door with button-head bolts; the nuts outwards, as a rule. The door was held in place when closed with two hasps on the bottom near each corner. The hasps were fastened similar to the hangers. Later the car door attachments were improved, and brackets were applied to the side of the car, at the bottom of the door, which prevented the door from swinging outward over a safe distance when opened or unfastened. This plan, with a guard or shield over the top, is common practice to-day. From the plain top door slide and hanger to the hanger with rollers or sheaves progress has been very rapid. The complete set of door attachments without some weak point is not yet designed, or, at least, it is not in general use. The coming freight car door, to be satisfactory to both the transportation and mechanical departments, will require to embody these essential points: 1, safety; 2, protection to the property in transportation from theft, fire and water; 3, ease of operation, and 4, economy in first cost and cost of maintenance.

Mr. Miller presented the report of the committee on "Pistons, piston-packings, piston and valve-stem rod packing—the best in service and comparative cost." The committee considered the T-ring piston as decided-

ly superior to the solid piston, and gave particulars of experience with different packing, metallic packing being preferable to hemp. In the discussion of the report, Mr. Hibbard, Chief Draftsman of the Lehigh Valley R. R., urged the importance and necessity of reducing the weight of pistons, cross-heads and all reciprocating parts to enable the counter weights to be reduced. Mr. Mackenzie and Mr. West believed that it was more profitable to spend money on piston packings than to rebore cylinders. Mr. Ames said that on the Beech Creek they bore the cylinders until the limit is exhausted and then they are relined to bring them back to their original condition.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.—The second annual meeting will be held in New York city, at the house of the American Society of Mechanical Engineers on Nov. 15 and 16. The list of papers to be read at the meeting is as follows: "Some Suggestions of Professional Experience in Connection with the Naval Construction of the Last Ten Years," by Rear-Admiral Richard W. Meade; "The Use of Small Models for the Determination of Curves of Stability," by E. Bertin, director of the French Government School of Naval Design; "Some Obstacles to Shipbuilding and Owning in this Country," by George W. Dickie, of the Union Iron Works, San Francisco; "Present Status of Face-Hardened Armor," by W. T. Sampson, Captain and Chief of the Ordnance Bureau; "Cellulose and Its Application to Warships," by E. Cheveau, of Philadelphia; "Experience Gained with Our New Steel Ships, as Regards Care and Preservation," by Chief Constructor Philip Hichborn, of Washington; "The United States Triple Screw Cruisers 'Columbia' and 'Minneapolis,'" by Commodore George W. Melville, Engineer-in-Chief, United States Navy; "Electricity on Shipboard; Its Present Position and Future Development," by S. Dana Greene, of New York city; "Hydraulic Power for Warships," by Naval Constructor Albert W. Stahl; "Yachts in England and America," by Lewis Nixon, Philadelphia; "A Dynamic Steam Engine Indicator Tester," by Prof. Cecil H. Peabody and Prof. E. A. Miller, of the Massachusetts Institute of Technology; "Steamer and Tow-barge Efficiency and Classification of Lake Vessels," by Joseph R. Oldham, Cleveland; "Notes on Launching," by William J. Baxter; "Accessibility and Circulation of Water-tube Boilers," by L. L. Davis, Erie, Pa.; "Recent Light-Draft Gunboats of the United States Navy," by J. J. Woodward, Naval Constructor.

WESTERN RAILWAY CLUB.—The October meeting of the club was held at Room 732, The Rookery, Chicago, Oct. 16, 1894. A preliminary report on Interchange at Chicago was read by Mr. J. N. Barr, chairman of the committee appointed at the September meeting to draft a set of rules of interchange for railways entering Chicago, which should make the owners of cars responsible for a greater number of defects than are provided for in Rules 7, 8 and 9 of the M. C. B. Rules of Interchange. The report was merely the draft of an agreement to be entered into by the railways entering Chicago, and was not assented to by all the members of the committee. This agreement provided that owners of cars shall be responsible for repairs to the following parts, in addition to those provided for in the M. C. B. rules: Couplers and drawbars; drawbar springs; drawbar pockets or spindles; draw lugs and attachments; draw timbers; dead woods or buffers; end sills; longitudinal sills; cracked posts; all parts of trucks; center plates and all body castings, and all bolts. The main clauses of the agreement also provided (1) that all parties to the agreement should pass cars having any of the above defects without requiring defect cards; (2) that in interchanging cars with railways not parties to this agreement the regular M. C. B. Rules of Interchange should apply; (3) that any railway having to repair cars for above defects should have power to bill against the owner for such repairs; (4) that all repairs should be made in strict accordance with the original construction of the car, and (5) that any party to the agreement might withdraw from it upon 30 days' notice.

The discussion of the report was brief. Mr. C. A. Schroyer (Chic. & No'w'n) stated that he believed the proposed change would be a good thing provided the rules could be made universal, but as long as the parties to the agreement had to take some cars under the M. C. B. rules he did not see that much reduction in the force of inspectors could be made, and this was the great thing aimed at in the new rules. He also questioned whether the railways would enter into an agreement of this kind without some change being made in the present basis of mileage paid for cars.

Mr. G. W. Rhodes (C., B. & Q.) thought that the rules would lead to increased carelessness in switching cars, and consequently increased breakage. He would like to see some stipulation in the rules regarding rough handling of cars in yards.

Mr. J. N. Barr (C., M. & St. P.) referred briefly to the objections made by Mr. Schroyer and Mr. Rhodes. He fully realized the difficulties arising from having only a small number of railways participants in the agreement; but his idea was that if only a few railways entered into it, and the results proved the advantages of the change, then they could go before the M. C. B. Association and urge with far greater force the universal application of the new rules. In regard to rough handling, spoken of by Mr. Rhodes, he thought that the precautions which a railway took against the rough handling of its own cars would protect foreign cars, since the one could not very well be damaged without the other being damaged also.

Mr. Rhodes then offered the following clauses to be added to the agreement: (1) Railway companies which do not own equipment amounting to a certain number of cars per mile are not to become parties to this agreement; (2) cars damaged by switching in yards will not be regarded as coming under the head of wrecks or derailments unless the damage to any one car exceeds a certain number of dollars.

The discussion then closed with the understanding that a meeting of the representatives of the different Chicago roads should be held Oct. 27 to consult regarding the advisability of entering into an agreement similar to that presented in the report.

The first of the topical questions for the meeting was then taken up and discussed at some length by Mr. A. M. Waitt (L. S. & M. S.) and Mr. G. W. Rhodes. The question was, "Shall the Coach Step Go?" and was suggested by the removal of the coach steps by the Illinois Central R. R. on some of its suburban trains. The general tenor of the discussion was that while the coach step might be advantageously removed from cars in suburban and elevated railway service, that nothing of that sort could be expected in general railway service for many years to come.

The second topic was "Freight Draft Rigging Between Floor Sills." The discussion was opened by Mr. Wm. Forsyth (C., B. & Q.), who said:

I think that the C., B. & Q. was the first road to do away altogether with the draft timbers on freight cars. We commenced on low furniture cars in January, 1890, so that now we have had nearly five years' experience with that form of construction. The principal objection which was urged against it at the time was that it would injure the center sills, which are such a permanent and integral part of the car, rather than the short temporary draft timbers, which are not so important. Yet I have asked a number of our carmen if they ever saw any of our center sills with this draft rigging which were injured except by wrecks, and they told me no. In fact, I do not see how they very well could be with the protection of the iron plate that we use, and the connection of the drawbar stops with that plate, by which we have the value of our bolts that are in the draft rigging acting in either direction, and the bearing of our iron plate against the end sills.

Mr. K. D. Smith (C., B. & Q.): I wish to indorse what Mr. Forsyth says in regard to the fastening of the draft rigging to the center sills, and to give our experience from the repair yard standpoint. When the cars fitted with the draft rigging fastened to the center sills appeared in Chicago, our inspectors predicted that the center sills would not stand the rough switching service. Now, during the five years that we have had this draft rigging on our cars we have not had, to my knowledge, a sill that was broken by reason of the draft rigging being fastened to it. The draft rigging and sills of the cars are practically in as good condition as when first applied, and the sills have no re-enforce pieces to strengthen them. As first designed, a wrought iron plate was placed next the sill; and on it, and bolted through the sill, were placed the draw lugs, which depended entirely on three bolts to hold them. The shrinkage of the wood in the sill would loosen these bolts enough to make a shear of the wrought iron pieces, and the result was that, in switching service, the shock given the back or buffing draw lug would shear the bolts. To overcome this trouble, the wrought iron piece placed next the sill was made somewhat longer, and the ends flanged to make a stop, and an oak piece was placed between this flanged end and the iron transom. Since that change we have not had a bolt to remove on account of shearing or bending, and I have lately examined cars when jacked up on our repair track, and found the draft rigging and sills in as good condition as when first put up. I do not believe that a car builder will claim that draft timbers applied in the ordinary way, under the sills, will give a life of five years and be in good condition at the end of that time. By fastening the draft rigging to the center sills, we do not have to maintain the draft-timber bolts, which, we all know, are quite an item of expense.

Mr. G. L. Potter (Penna.): The Pennsylvania road, two or three years ago, built 200 or 300 furniture cars in that way, placing the draft rigging between the sills, and I have yet to hear of one of those cars failing as far as the draft rigging is concerned. It enables us to use a plate on the end sill so constructed that a hole passes through it, through which the drawbar is applied. The metal which is removed to form that hole is in the shape of a flange surrounding the hole. This gives a bearing surface for the coupler and also strengthens the plate, making something in the form of an angle iron. With a construction of that kind the M. C. B. coupler could be changed so that it would be very materially benefited; that is, the guard arm could be made so that it would have a bearing on the end sill so that any shock which the guard arms might take up would be transferred directly to the end sill by a pressing strain rather than by the strain that they are now subjected to.

Mr. G. W. Rhodes said that he approved all that had been said by Mr. Forsyth and Mr. Smith. The reason why this form of draft rigging was better than that attached under the sill was that the line of draft and shock was raised above the bottom of the sills, and the leverage of the attachments was therefore greatly reduced. Mr. Jas. Townsend (Chic. & Alt.) stated that his experience had been directly contrary to that of the C., B. & Q. R. R., for he found that they soon knocked out the draft rigging, and it cost much more to put in a center sill than it did to put in a draft timber.

This discussion was followed by a paper by Mr. A. M. Waitt entitled "The M. C. B. Coupler in 1894."

Mr. Waitt considered that the past year had been one of very considerable improvement and development in the M. C. B. coupler. The various coupler manufacturers had undertaken in earnest the work of removing the weaknesses which the numerous tests had brought out, and endeavored to improve the design of their couplers, with the result that a much simpler and better coupler can now be bought than has ever been the case. On the other hand, however, some manufacturers had so altered their designs as to prevent interchangeability, and this was much to be regretted. Personally he had become more firmly convinced than ever that malleable iron was superior to steel for couplers. A pleasing feature of the past year was the change wrought by experience and observation in the opinions of some railway officers who were formerly strong opponents of the M. C. B. coupler. Considerable attention had been paid to so adding to or modifying the parts of couplers that the knuckles would be self-opening; but it was a question whether the attempts thus far had been very successful. From information collected from about 40 railways it appears that the coupler-casting breakage varied from 0.75% to 17% per year, and the knuckle breakage from 0.5% to 20% per year, which was considerably above what economical service would permit. It was gratifying to note, however, that the recent improvements were reducing the breakages materially. The information showed that breakages in the shank were unusually frequent, and it was to be hoped that at the next M. C. B. convention some move would be taken to increase the size of the shank ½ in. each way. In closing, the author referred to the valuable work which the M. C. B. Association is doing in fostering the improvement and the rapid adoption and application of the M. C. B. coupler.

At the November meeting Mr. J. N. Barr will read a paper entitled "The Scrap Heap."

COMING TECHNICAL MEETINGS.

FRANKLIN INSTITUTE, PHILADELPHIA.
Nov. 2. "A Trip through Germany," by C. J. Hexamer
Secy., W. H. Wahl.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Nov. 5. Secy., C. L. Annan, City Engineer's Office.
ENGINEERS' CLUB OF PHILADELPHIA.
Nov. 3. Secy., L. F. Rondinella, 1122 Girard St.
WESTERN SOCIETY OF ENGINEERS.
Nov. 7. Secy., Thomas Appleton, Lakeside Bldg., Chicago.
ENGINEERS' CLUB OF ST. LOUIS.
Nov. 7. "Progress in Steam Engineering." Secy., W. H. Bryan, Turner Block.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Nov. 7. Secy., Francis Collingwood, 127 E. 23d St., N. Y.
ENGINEERING ASSOCIATION OF THE SOUTH.
Nov. 8. Hunter McDonald, Nashville, Tenn.
ENGINEERS & ARCHITECTS' CLUB OF LOUISVILLE.
Nov. 8. Secy., G. W. Shaw, Norton Building.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
Nov. 8. Secy., C. H. McLeod, 112 Mansfield St., Montreal.
MONTANA SOCIETY OF CIVIL ENGINEERS.
Nov. 10. Secy., G. O. Foss, Helena, Mont.
ENGINEERS' CLUB OF INDIANAPOLIS.
Nov. 10. Secy., C. C. Brown.
WISCONSIN POLYTECHNIC SOCIETY.
Nov. 12. Secy., Geo. G. Mason, 144 8th St., Milwaukee.
ENGINEERS' CLUB OF KANSAS CITY.
Nov. 12. Secy., F. W. Tuttle, Baird Building.
NORTHWESTERN RAILWAY CLUB.
Nov. 13. Secy., W. D. Crosman, Ryan Hotel, St. Paul.
NORTHWESTERN SOCIETY OF ENGINEERS.
Nov. 13. Secy., D. W. McMorris, Burke Building, Seattle, Wash.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Nov. 13. Secy., F. C. Osborn, 721 Hickox Building.
DENVER SOCIETY OF CIVIL ENGINEERS.
Nov. 13. Secy., F. Ed. King, 36 Jacobson Block.
NEW ENGLAND RAILROAD CLUB.
Nov. 14. Secy., F. M. Curtis, P. O. Box 1576, Boston, Mass.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Nov. 15. Atlanta, Ga. Secy., F. A. Charpiot, Macon, Ga.
SOCIETY NAVAL ARCHITECTS & MARINE ENGINEERS.
Nov. 15 and 16. Annual Convention in New York city.
Secy., W. L. Capps, U. S. N., Washington, D. C.
ENGINEERS' CLUB OF CINCINNATI.
Nov. 15. Secy., J. F. Wilson, 24 W. 4th St.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Nov. 15. Secy., D. Carhart, Carnegie Library Building, Allegheny.
NEW YORK RAILROAD CLUB.
Nov. 15. Secy., John A. Hill, Temple Court, N. Y. City.
ENGINEERS' CLUB OF MINNEAPOLIS.
Nov. 19. Secy., E. Nexsen, Kasota Block.
WESTERN RAILWAY CLUB.
Nov. 20. Secy., C. F. Street, Rookery Building.
COLUMBIAN ENGINEERING SOCIETY.
Nov. 20. Secy., F. W. Hart, Washington, D. C.
ASSOCIATION OF ENGINEERS OF VIRGINIA.
Nov. 21. Secy., J. H. Pilcher, Roanoke, Va.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Nov. 21. Secy., S. E. Tinkham, 36 Bromfield St.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Dec. 3 to 7. Secy., F. R. Hutton, 12 W. 31st St., New York
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Dec. 7. Secy., O. Von Geldern, 719 Market St., San Francisco.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Dec. 14. Secy., D. W. Meeker, St. Paul, Minn.
CENTRAL RAILWAY CLUB.
Jan. 13. Secy., S. W. Spear, East Buffalo Iron Works, Buffalo, N. Y.

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The "Lucania" has surprised every one by again lowering the transatlantic record, in a month when a good deal of stormy weather may be expected on the North Atlantic; and as a matter of fact a part of the voyage was made over a rough sea. The run between the lightships was made in 5 d. 7 h. 28 m., a record so much better than the best performance of any other vessel that none is likely to equal it, unless it be her sister vessel, the "Campania."

The city of Joliet, Ill., is trying to imitate Chicago in compelling the removal of grade crossings, and proposes to fine each railway passing through the town $100 per day for each day of failure to obey an ordinance recently passed requiring the railways to elevate their tracks. The population of Joliet by the last census was 23,264. If every Western city of this size, or larger, undertakes to emulate Chicago in abolishing grade crossings, the condition of the much-maligned corporations will be enough to arouse sympathy in a heart of stone. The fact is, that by fostering the building of railways until from two to half a dozen have to divide between them a traffic which any one of them could carry, the revenues of many railways in this country have been fixed at a point which acts as a permanent barrier to many improvements that are, in the abstract, most desirable.

Many of our readers will recall the interest excited at the time of the Brazilian Civil War a year ago when the old Ericsson torpedo boat "Destroyer" was purchased by representatives of the Brazilian government, was equipped with a pneumatic dynamite gun, and set sail from New York, in company with other vessels purchased at the same time, to put down the rebellion in Brazil. The vessel never had a chance to show what her huge weapon was capable of, as before she arrived at the scene of hostilities, the rebellion was at an end. On another page of this issue will be found an interesting paper by an American officer who has been in charge of the gun on board this vessel from the time of its commission in the Brazilian Navy.

The conclusion he reaches, to the effect that the range of the dynamite gun is too small and its accuracy of fire too poor to make it a serviceable weapon on shipboard, is precisely that reached with reference to it by the United States Naval authorities. The pneumatic dynamite gun may serve a valuable purpose as a weapon for coast and harbor defence; but the "Vesuvius" and the "Nictheroy" appear to have pretty well determined that its place is not on shipboard.

Our new navy evidently means more than new ships, if these ships are to be constantly and economically maintained in serviceable condition. From the annual report of Chief Naval Constructor Hichborn, just issued, we learn that while fairly good progress has been made in naval construction during the past year, the well-being of the new ships already in service demands large expenditures in another direction. Modern steel ships require much more attention than did the old wooden vessels constituting the navy of a few years ago, and, as a consequence, our navy yards require extensive overhauling and additions to their plants for the economic handling of the work now coming to them. Steel ships require frequent docking under the ordinary conditions of peace, and yet it is only possible to dock some of the larger vessels under the most favorable conditions of tide, and over long stretches of our coast no conveniences whatever exist for overhauling these same ships. The character of some of the additions to existing navy yard plants, aside from larger docks, is indicated in the navy yard estimates submitted by Mr. Hichborn. These include new tools of all descriptions, powerful cranes and floating derricks, plate-bending machinery, galvanizing and electric power plants, steam hammers, and suitable buildings to hold this new plant. While strict economy in all public expenditure is to be commended, it is evident that the expenditures recommeneded are not only in the interests of true economy, but are absolutely necessary for the practical fighting and cruising efficiency of some of the most valuable ships in our new navy. Our system of naval construction has been entirely revolutionized within a few years, and our navy yards must keep pace with the demands and requirements of our modern ships, absolutely new in material and equipment.

Another and very valuable report upon long-span bridges has just been made public. Last January Secretary of War Lamont appointed Major C. W. Raymond and Captains W. H. Bixby and Edward Burr, all of the Corps of Engineers, U. S. A., a board of experts to collect accurate and full information necessary to the intelligent and proper determination of questions arising in the War Department connected with the building of bridges over broad navigable streams. This board was entirely distinct from the Hudson River bridge board, appointed last June, and whose report was published in full in our issue of Sept. 6, inasmuch as the latter board was created by authority of Congress, with the special purpose of investigating the feasibility of a single-span structure across the Hudson. The War Department engineer board has taken a wider field, and in its first report treats of the possibility of erecting bridges of longer span than any yet constructed. It goes into the subject deeply and thoroughly, and the result is a contribution to engineering literature that is both unique and valuable. Its present great interest, however, centers in its application to the spanning of the Hudson River at this port, and in the assertion, fully proved by figures, that it is not only possible to erect a single-span structure of 3,200 ft. at this point, but that a suspension bridge of 4,335 ft. span is also practicable. Leaving all detail for the full report, to be given in another issue, it is sufficient to say that the board takes up in full the proposed Hudson River bridges and the report of the board of experts last June. They point out, as has already been done by Mr. Hildenbrand in our issue of Sept. 13, that the estimates of that board were maximum estimates, and it was expressly stated that they were not absolute. The board of army engineers makes its own calculations on a site at 66th St., more favorable in foundation depths, and thereby saving the sum of $2,900,000 in that item. It then thoroughly and completely works out the details of a 3,200-ft. suspension bridge designed for six tracks, and finds that $23,000,000 is a reasonable estimate of cost for such a structure. This is $2,443,000 less than the cost of the proposed 2,000-ft. span cantilever bridge, as estimated by the board reporting in September, and $7,743,000 less than the cheaper of the two 3,200-ft. suspension bridge designs estimated upon by the same board. While we fear that some time will elapse before a bridge of any type of construction or of any span is built across the Hudson River at New York, it is an interesting contribution to engineering knowledge to have the subject so fully discussed and the practicability of such enormous single spans scientifically investigated. When it is remembered that the longest existing span is only about 1,700 ft., the true dimensions of the problem here handled are apparent, and the possibilities of single-span structures over broad navigable streams are made evident.

In our issue of June 28 we referred briefly to the harm which is being done to really meritorious ship canal projects by the indiscriminate manner in which deep waterway enthusiasts are accustomed to advocate the construction of such works in all sorts of possible and impossible localities. On another page of this issue we give considerable space to a description of the proposed Lake Superior & Mississippi River Ship Canal across northern Minnesota, for the survey of which the government will expend $10,000 during the next few months. This work fits the text of our former remarks so well that it seems desirable to give it some further attention here than its merit would otherwise entitle it to. A canal from Lake Superior to the Mississippi River, constructed according to the routes shown on the map, would be from 200 to 330 miles long and would have a summit level from 470 ft. to 800 ft. above the level of Lake Superior. Just what the difficulties of excavation and securing the necessary water supply will be can only be guessed at; but, laying these aside, there is, under the most favorable circumstances, an ascent of 470 ft. from Lake Superior to the summit level; and thence a descent of 400 ft. to the Mississippi River, which must be overcome by locks. If we allow each lock the very generous lift of 20 ft.—it is more likely to be one-half of this—this will require 43 locks, each of which must be large enough to pass the largest lake barge capable of navigating a 20-ft. channel. Each of these locks, besides adding largely to the first cost of the canal, means a cost to operate, an extra expense over the ordinary canal prism to maintain and a delay to traffic. In addition to the cost of the canal proper there will be the cost of dredging and maintaining a 20-ft. channel in the Upper Mississippi, a work which is absolutely necessary to the full usefulness of the artificial waterway. With all these considerations, we must remember that a canal which will eventually connect the Great Lakes and the Mississippi River is already well advanced in its construction. We refer, of course, to the Chicago Drainage Canal and the deepening of the Illinois River. So much for the construction. What is there to show for traffic and what will be the saving in freight rates on that traffic over the many low-grade, well-equipped railway lines now carrying it? For export, the region traversed by the canal has lumber, wheat, corn and other forest and farm produce, and for import, agricultural and milling machinery and general farm supplies in considerable quantities, but the bulk of the west-bound traffic is coal from the Eastern mines. Illinois and Iowa coals can already reach Duluth and the Twin Cities by water routes almost as direct as the proposed canal. The Lake Superior iron ores now go east, and will continue to do so so long as Pennsylvania produces coke and Illinois and Iowa do not. The question is, then, whether there is enough bulk freight, in which only can canal transportation hope to compete with railway transportation, and enough saving in transportation rates on this freight to pay the interest on the cost of the canal.

The phrase, "bringing the ocean to the wheat fields," which the newspapers and promoters of the canal are so fond of repeating, sounds well, but we fear that it is something like the Mountain coming to Mahomet. That was very fine to talk about until the results were analyzed, and it was then pretty clear that it was a much less stupendous task and involved much less wear and tear for Mahomet to go to the Mountain.

The city of Duluth has shown its good sense in voting, by a large majority, against building water-

works to compete with the private company now supplying the city, although declaring itself unmistakably in favor of city ownership. A number of separate propositions were voted on, the outcome being that $1,000,000 was voted for buying the private water and light plant, and $600,000 for extending the same. This adds one more to the list of large cities which are changing from public to private ownership. The election was a special one, and the vote was light, only 4,332 votes being cast out of 10,223 names on the registration lists. Not long ago the people of Duluth gave an almost unanimous vote against issuing bonds to aid a big water-power scheme, as set forth in detail in our issues of May 25, June 8 and 22, 1893. From the vote at these two elections it would appear that the citizens of Duluth have a pretty clear conception of at least two sound principles of municipal polity, (1) that no city should attempt to construct and operate a water-works plant to compete with private works, unless there are exceptional reasons for doing so; (2) that, as a general rule, a city should not incur a bonded debt to aid a private enterprise, and never when such an enterprise is in an embryo stage.

The voters of New York city are to decide at the election during the coming week the question whether the city shall undertake the construction of a rapid transit railway, and from all present signs the measure is likely to be carried with little opposition. The need of such a railway is everywhere admitted, and merely as an abstract question all intelligent citizens are practically agreed that it is wise for the city to build and own such a line, arranging with private parties for its operation under contracts carefully drawn to protect the public interests. The question whether this best method can be adopted in practice without opening the door to corruption and peculation will doubtless lead many to vote against it, and to do so conscientiously, believing that the best interests of the city are subserved thereby. It must be remembered, however, that the present rapid transit act has been drawn with great care to shut out and reduce to the minimum the opportunities for fraud, and it has the approval of the most conservative commercial bodies in the city. Again, it is to be considered that action by the city of some sort with respect to its rapid transit facilities is a necessity, and there is danger that if the present opportunity to construct a real rapid transit railway is not taken advantage of by the people, we may yet see some company with strong political backing secure a franchise to obstruct the streets with more elevated railways, and that without making any return to the city for the privilege. A real rapid transit railway, on the other hand, extending the entire length of the city, will be not alone an enormous improvement and benefit to real estate, but will yield a revenue of many millions, which will increase year by year with the growth of the city.

It has been urged with much force in this connection, moreover, that it is by no means certain that the best way to purify city politics is to decrease the responsibility and the power of municipal governments. It may be that instead the best plan is to increase the city's powers and duties, and thus teach the average voter that the city is really a business corporation in which he has an interest, and that state or national politics are as much out of place in its administration as they are in the management of a manufacturing or mercantile company.

Within the past few years there has sprung up in this country an urgent demand for the sanitary and economical disposal of the garbage of cities. Previous to 1885, so far as we can learn, every American city rid itself of its garbage along the lines of least resistance, employing the cheapest means possible without causing too many complaints. In fact, this is still the most common plan followed. But from 1885 to the present day one city after another has had forced upon it, by the demands of a public, educated by its health officials and made impatient by unsavory odors and disagreeable sights, the necessity of adopting some scientific method of garbage treatment. During the past two years, especially, a large number of cities have investigated the matter, and many have adopted some system of garbage destruction or utilization.

The terms destruction and utilization describe as accurately as single words can the aims and methods of the two classes into which modern systems of garbage disposal may be divided. The promoters of destruction systems, however, or some of them, while urging that the disposal of the garbage is the primary object of their systems, claim that the ash residue is of value, and of late are beginning to maintain that heat from their furnaces can be utilized in various ways, according to local conditions. Of course the advocates of each system, at least those commercially interested, belittle the advantages of the other, and urge that theirs alone is sanitary and economical. But there seem to be no engineering impossibilities in the way of making either system thoroughly sanitary, the important questions being those of cost of construction and operation, and freedom from the danger that the process will be improperly conducted to avoid expense. Obviously it must cost more to construct and operate a utilization than a destruction plant; but whatever commercial products may be derived from a utilization process are available for the reduction of the charges against the system. Which system of disposal is preferable, either from a sanitary or monetary standpoint, it is not the purpose of the present article to discuss, but it is hoped that useful figures bearing on this point may be made available in the future.

Four of the largest cities of the United States are now having all their garbage treated by the Merz utilization system, an extended description of which is given elsewhere in this issue. It will be seen from the description of the plants now operating under this system at St. Louis, Buffalo, Milwaukee and Detroit, that many engineering problems are involved in the construction and operation of such works, and the same is true of other improved methods of garbage disposal. Already engineers are being called on to design or report on systems of garbage disposal, and in the future much work of this sort may be expected.

Garbage, in its broader sense, includes about all those city wastes not capable of disposal by means of a sewerage system, and which are liable to become offensive through putrefaction. These wastes amount to hundreds of tons a day in our larger cities, as is shown by the fact that in St. Louis during the month of August an average of 227 tons a day was delivered to the Merz factories for treatment.

With the problems of sewage disposal on the road, at least, to a highly satisfactory solution, with sanitary and economical methods of garbage disposal now available for adaptation by engineers to the local needs of any community, and with water purification no longer a doubtful question, it may well be felt that the close of this century marks the opening of a new era in the sanitary history of American cities. There is good reason to hope that the next few decades may see the general adoption by American cities of means for securing pure water and disposing of dangerous or offensive wastes, and that these reforms will greatly reduce the death rates and increase the health and general prosperity.

As an outcome of the International Engineering Congress held in connection with the Chicago Exposition last year, an effort is being made to establish an International Institute of Engineers and Architects. According to a circular just received the principal objects of this Institute would be as follows: To unite in closer relations all departments of engineering and architecture; to furnish a suitable and convenient channel by which information relating to new discoveries, processes, methods, inventions and work may pass from one country to another for the general benefit of the profession; and, finally, to conduct, by the assistance of the Fellows of the Institute, individuals and governments, systematic and thorough tests of all classes of structural material. Any person engaged in the profession of engineering or architecture, of mature age and good character, would be eligible to election as a Fellow of the Institute, and any five Fellows resident in one country could organize into a national board for that country by complying with the constitution of the Institute and communicating their action to the general secretary of the international board. This international board of direction would have charge of all matters of general policy, changes in the constitution and all international congresses, and this board would be made up of presidents of the national boards of direction and five of the members of the board of direction of the United States. The president of this latter board would be the president of the international board. The members of the national board of the United States would also constitute the international executive committee, which should have entire control of the details of the business and management of the Institute.

The work of the Institute would be the publication of professional papers, after approval by the national boards of direction, in the English, French, German and Spanish languages, and "the proceedings would be printed monthly in each of these languages." The field of the Institute is planned to include civil, mining and metallurgical engineering, mechanical, electrical and marine engineering, naval architecture, military engineering, engineering education and architecture. There would be a special division for each one of these branches, and the applicant for membership must state to which one he desires to belong, and will then receive the publications of that division only. But by the payment of $5 extra for each division he may receive the publications of any or all of the other divisions. All measurements given in the papers are to be expressed both in English and metrical equivalents. The first Congress of the Institute would be held in Paris in 1900, during the international exposition of that year.

The above gives briefly the scope of the proposed Institute, as outlined by Mr. Elmer L. Corthell, M. Am. Soc. C. E., the late chairman of the General Committee of the International Engineering Congress, and the moving spirit in this broader enterprise. Mr. Corthell has been devoting much time and energy to the organization of this Institute, and from his intimate relations with, and well-established professional reputation among, foreign engineers, he should know the dimensions of the task he sets himself and his friends. But to those without this intimate knowledge and close study there would appear to be several very serious stumbling blocks in the way of thus uniting the engineering interests of all civilized nations. The first of these would be international jealousy; though it is doubtless with the purpose of minimizing this influence that Mr. Corthell makes the president of the Institute a citizen of the United States and places all executive control in the hands of the United States members. This arrangement might modify the individual prejudices of Englishmen, Frenchmen and Germans among themselves; but it would be quite as likely to unite all three against the engineers of the United States in an enterprise of this nature, and thus, at the beginning, wreck the sole purpose of its being. But even supposing that this international combination of engineering interests were possible, there are many difficulties of detail to be overcome in controlling this body and in properly meeting the wants of the widely-diversified membership. Not the least of these difficulties would be to keep alive the common interest in the Institute and its general welfare. What this means may be illustrated by the comparatively very slow growth of our own national engineering societies, and the lack of public and professional interest shown toward them. The inside history of these societies shows that they have reached their present measure of success only by the steady and unremitting perseverance of a few earnest members in each, and the personal and social element, which would be, to a large degree, eliminated in an international society, has been a large feature in securing their success.

There has been much talk in the past, and it recurs more or less from time to time, concerning the possibility of merging the four national engineering societies of this country in one organization; but such schemes have always come to naught and seem always likely to do so. The proposition to found a new national society, to which the members of highest professional standing in the other societies should alone be eligible, which, at one time, attracted considerable attention, also died a speedy death.

On the other hand, there are some manifest advantages which might be brought about if some

features of co-operation between the different societies could be introduced, without sacrificing in any degree of the individuality of each.

Mr. Corthell's proposition to give the members of any society the privilege of receiving the transactions of any other society at cost price and the proposition to agree upon a common time and place for holding a yearly meeting are schemes which could be put into practice in this country without in any way affecting the independence and equality of the separate societies. Yet, notwithstanding this, so small is the demand for co-operation among the national societies that the first step in this direction is yet to be taken.

Is there a greater demand for co-operation on international lines? If there is, we fail to discern it. The engineers in this country who show most interest in the work of the profession in Continental Europe are chiefly the few in the front ranks of the profession who are abundantly able to obtain such professional information as they desire from the published proceedings of the foreign engineering societies and the files of the technical journals.

The rank and file of the profession, so far as we can discern, are too busy to do more than keep up with American engineering progress, and the vast mass of foreign technical literature is of so little practical value to the average engineer on this side of the water that few pay any attention to it.

Would it not be better, then, to bring about co-operation first on national lines, where the work can be most easily done and the benefits are most readily perceived. When that has been accomplished it will be in order to work for international co-operation.

BROKEN STAMP STEMS AND CRYSTALLIZATION BY VIBRATION.

In our issue of Oct. 4 we gave considerable space to a discussion before the American Institute of Mining Engineers on the question whether constant jar and vibration change the molecular structure of iron or steel from fibrous to granular. As stated then, the notion that crystallization by vibration does occur is one which has a wide acceptance and is tenaciously adhered to by many so-called "practical" men. On the other hand, engineers who have carefully sifted all available evidence bearing on this question are fairly unanimous in the opinion that such crystallization has not yet been clearly shown to occur, although from the nature of the case it is practically impossible to prove that under some unknown circumstances such a transformation of structure is not possible.

The exciting cause of this interesting discussion in the Mining Engineers' Institute was a casual remark with reference to the vibration of a stamp mill and the deterioration of the ironwork of the mill which was supposed to result from it. There are probably few better places to test the effect of vibration on metal than a stamp mill; with its steady day and night work and its continual concussion. The breakage of stamp stems has been frequently referred to in proof of the claim that crystallization is due to vibration. Since the publication of the report of the Mining Engineers' discussion above referred to, we have received from a prominent manufacturer of mining machinery a letter from a South American customer giving the record of stamp stems in his mill. We quote the substance of the letter as follows:

Dear Sirs: The "El Callao" Mill uses 60 stamps of the following weights: Stem, 392 lbs.; tappet, 113 lbs.; boss, 190 lbs.; shoe, 155 lbs.; total weight (when new), 848 lbs. These run at a speed of 95 (8-in.) drops per minute, and are fed by Challenge feeders. The top and bottom guides are of hard wood, with faces of 12 and 14 ins.

The stems, which are 3 7-16 ins. in diameter and 14 ft. in length, are of wrought iron, and weigh 392 lbs. There have been used, in the past eight years, 537 new stems. The number of breaks for the past five years are as follows:

Year.	1889.	'90.	'91.	'92.	'93.
No. broken stems....	123	57	71	58	27

The total breaks in five years are thus 336; which indicate an average life of all stems of about 46 weeks.

The stems generally break square across the fiber, just above the upper part of head, but occasionally below this face or in the head.

I believe, as a rule, the broken stems are due to the metal crystallizing. Slight differences in vibration and strain and composition of metal vary the length of the time required to crystallize sufficient to cause a fracture.

The average life of the stems shows that generally the fracture is not due to flaws or heterogeneous metal, although this is sometimes the cause.

The above letter is probably a fair sample of the evidence presented in support of the theory that stamp-stem breaks are due to crystallization. Let us see just what the evidence shows. While the letter does not distinctly state it, we are led to suppose that the fracture of the stems showed a granular structure. If this is the case, however, it would prove nothing, as it is a well-established fact that good fibrous wrought iron, if broken square across the fiber by a sudden shock, will show a fracture which can easily be mistaken for a crystalline structure, the ends of the broken fibers appearing like the faces of crystals.

But it will be noticed that the writer states that "the average life of the stems shows that generally the fracture is not due to flaws." In other words, we are led to believe that there was some approach to uniformity in the life of these stems. If this is really the case, then the evidence is good that some deteriorating influence was at work upon the stem from the time it was put in service. If the breakage of the stem were due to a chance hit giving the stem a side strain, then such a chance hit would be as likely to occur at one time in the life of the stamp as another; and after the small percentage of stems with flaws was eliminated the "death rate" should remain fairly constant, and there should be a fairly large number of stamps which would run for two years without breaking and an occasional one should attain a much longer period of service. The above letter, though not positive in its statement, seems to indicate that this was not the case, and the inference, therefore, is that the stems were pretty certain to break after having been a certain length of time in service. It will be noticed also that the writer states the breaks to have been generally square breaks near the bottom of the stems.

As most of our readers probably know, in working a stamp mill the stamps are lifted by cams and are allowed to drop freely. The greatest strain to which the stem is subjected is the compressive force due to the sudden stoppage of the stamp at the end of its fall. The whole stamp, in the case cited in the above letter, gives a blow of 565 lbs. Of this amount about 335 lbs. is generated by the weight of the stem and tappet, and thus is transmitted through the lower end of the stem. The question now comes, what unit compressive strain is set up by this energy at the instant of impact?

In our issue of Aug. 2 we discussed at length the reasons why the question what strain is produced by a shock of a given energy can never be exactly answered. In the case in question the strain would depend chiefly on the material which the stamp shoe struck. If it fell upon a mass of soft rock whose crushing was just about sufficient to absorb the energy of the blow, the unit strain in the lower end of the stamp stem would be very moderate. On the other hand, if the shoe struck squarely on the chilled cast iron die, it is by no means impossible that the compression at the lower end of the stem might exceed the elastic limit of the metal. What the effect of such repeated compression beyond the elastic limit would be, can only be conjectured; but we know that repeated stretching of metal beyond its elastic limit gradually makes it brittle. It is not unreasonable to suppose, therefore, that repeated compression of metal may cause a "fatigue" that will gradually diminish its ability either to resist a steady strain or to absorb without rupture the energy of a blow.

If experiment should determine that stamp stems do actually fail in service through the causes above laid down, the fact will be a most interesting and important one. It is important to note, however, that if this be demonstrated to occur, it will not at all affect the dictum that vibration and shocks have no effect on the structure of iron or steel so long as the metal is not strained beyond the elastic limit. That repeated straining beyond the elastic limit makes iron or steel hard and brittle is among the most familiar of facts, and it is yet to be shown that metal which fails under repeated shocks does not fail merely from "fatigue" or repeated straining beyond its "yield point."

We alluded in a recent issue to the advantage to be gained by setting the graduates in our technical schools at work to solve problems of practical importance, if they undertook original investigation for their thesis work. Here seems to be an excellent opportunity for some of the students in the younger technical schools in the Far West to distinguish themselves. They should not find it difficult to procure a half-dozen stamp stems which have been in service for a year or so, and almost any college laboratory should contain sufficient equipment for their testing. If it is found that the lower part of the stem is more brittle than the upper, the theory as to the cause of breakage which is set forth above will be strengthened; if all parts of the stem are found to have undergone a like deterioration, it will be good evidence that vibration and shock can injure metal, even though the elastic limit be not exceeded; and if the metal of the stem is found to be throughout as good as when new, it may be fairly concluded that the shocks have not been sufficient to strain the metal beyond its elastic limit.

Whatever the result, it is to be hoped that we may have from some source an intelligent investigation to determine the facts, for the question is one of much practical importance.

LETTERS TO THE EDITOR.

A FAST RUN ON THE BIG FOUR.

Sir: On the morning of Oct. 26 this division of the Cleveland, Cincinnati, Chicago & St. Louis Ry. had a carload of U. S. soldiers to take from Columbus, O., to Springfield, O., to make connection with and attach the car to train No. 17, due to leave Springfield at 6:55 a. m. on our Peoria division. For some unavoidable reason the special did not leave Columbus at the time intended, being delayed some 33 minutes. The engineman was instructed to run to Springfield as fast as he could, and from the schedule given below, which was taken from the train sheet, I think you will agree with me in saying that he did run about as fast as he could.

Mile post.	Station.	Time.	Min.
0	Columbus	depart 6:33 a. m.	
10.0			
10	Galloway's	6:45 "	12
6.8			
16.8	Lilly Chapel	6:54 "	9
8.7			
25.5	London	7:05 "	11
17.7			
43.2	O. S. Crossing	7:20 "	15
2.0			
45.2	Springfield	arrive 7:23 "	3

Between Columbus and Galloway's one dead stop had to be made for the P., C., C. & St. L. crossing, also at London a dead stop had to be made for the P., C., C. & St. L. crossing. The summit between Columbus and Springfield is at mile post 33. The elevations (taking the level of water in Lake Erie as the datum) are as follows:

Columbus	175.5
Mile post 33	669.5
Springfield	407.5

The grade between Columbus and Springfield is quite broken, the maximum being 1%. The run from London to the Ohio Southern crossing was very fast, 17.7 miles being run in 15 minutes.

The locomotive used was built at the company's shops at Cleveland about ten years ago. It is an eight-wheel passenger engine, with 17 × 24-in. cylinders, and driving wheels 56 ins. in diameter.

Yours truly, J. C. Nelson,
Engineer Maintenance of Way, Cincinnati-Sandusky Division.

Springfield, O., Oct. 27, 1894.

CRACKS IN A CONCRETE COPING.

Sir: In reply to the letter of Mr. Low, in your issue of Oct. 18, which shows a reservoir coping, about 200 ft. long, built in one piece, I want to state that this and his account has, in my opinion, nothing to do with the question of expansion of concrete. It touches quite a new line; this is the building of large horizontal slabs of concrete, such as sidewalks, in one piece. The current practice is to build such horizontal slabs in pieces no larger than 7 ft. square, and this would necessitate, in the work referred to, joints every 20 ft. These joints are generally made by inserting tar-paper or by a jointing tool, which will prevent adhesion of the blocks. Thus the 16 cracks, which appeared one month after construction, seem to be sufficiently explained by the settlement of the structure.

The reason for this practice is not only that the concrete can be better laid in separate slabs, but that on a horizontal plate of the thickness used for sidewalks, the slightest uneven settlement, though not visible to the eye, can produce tremendous bending forces and can easily crack to pieces slabs of far greater strength. For the same reason a continuous concrete block under a building, a practice which has been used several times in Chicago, and also some older examples in Hamburg, Germany, cannot be approved. Forces which are practically irresistible may be developed by the unequal settlement; and the practice of separate column footings on the concrete-iron combination, as used in Chicago by Mr. Corydon T. Purdy, is far preferable. Yours truly,

New York, Oct. 22, 1894. Fr. von Emperger.

THE HARTFORD STEEL TIES ON THE NEW YORK CENTRAL R. R.

Sir: I have, in accordance with my annual custom, just had taken up for examination one of the Hartford steel ties, laid in the main track of the Hudson River Division, near Garrison Station, and have received the following report upon it from the examiner, Mr. O. W. Eggleston, Assistant General Roadmaster:

The tie is in very good condition. Very little corrosion in spots on under side of tie, at the point where the rail comes in contact with the tie; between the bolt holes there is perceptible a slight wear on the outer edge of base; the bolts are in good condition. I think, on the whole, the ties show up very favorably for the five years' service they have now had.

Yours truly, Walter Katte,
Chief Engineer, N. Y. C. & H. R. R. R.

New York city, Oct. 18, 1894.

THE PROPOSED LAKE SUPERIOR AND MISSISSIPPI RIVER SHIP CANAL.

The surveys for a ship canal from Lake Superior to the Mississippi River, near St. Paul, Minn., to provide for which $10,000 was appropriated by the last Congress, are expected to commence this fall. The project for a Superior-Mississippi ship canal was first actively considered in 1875, when a commission was appointed by the Governor of Minnesota, Hon. C. K. Davis, to examine into the practicability and desirability of such a work. Nothing came of the work of this commission and the project slumbered until the early part of this year, when the St. Paul Chamber of Commerce began to advocate the scheme, and through the agency of Hon. A. R. Kiefer, member of Congress from that city, the bill mentioned above was passed by Congress. This bill called for a canal 120 ft. wide and 20 ft. deep. What further steps will be taken by the government will, of course, not be known until the surveys are completed, but meanwhile the business men of St. Paul are actively working to raise the sentiment of the people in favor of the enterprise.

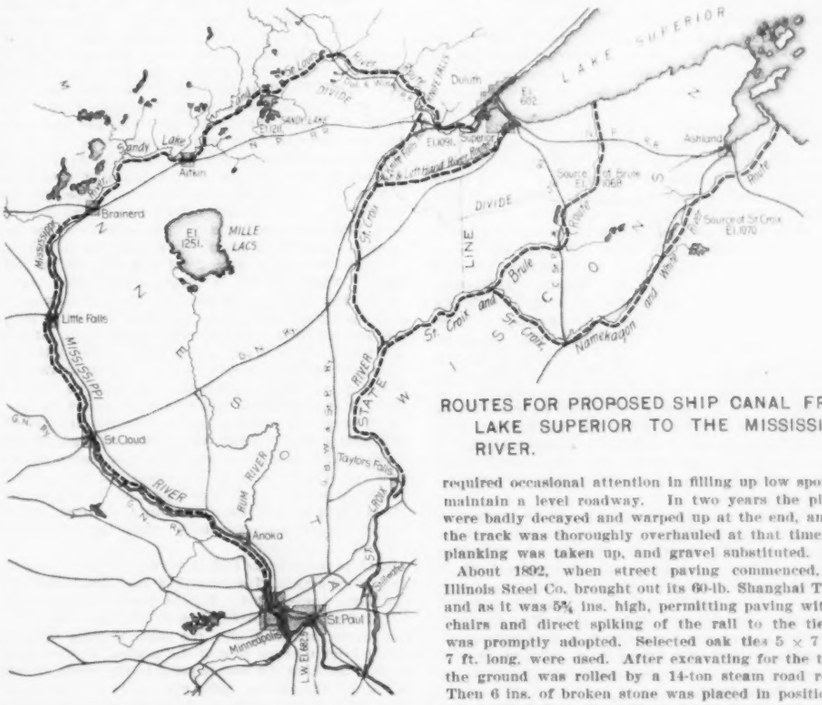
The promoters of the proposed canal claim that any one of five different routes are feasible from an engineering point of view. These five routes are shown on the accompanying map, prepared for the St. Paul Chamber of Commerce by Fowble & Fitz, Civil Engineers, of that city. The length of each of these routes and the elevations of the divide and of the southern terminus above the level of Lake Superior are shown in the accompanying table. It must be understood that these figures are based solely upon such knowledge of the topography of the country as is readily available, and that it is quite possible that the proposed surveys may develop facts which will show some other route to be much better than any of the five shown by the map.

Route.	Distance. Lake Superior to divide. Miles.	Distance. Lake Superior to Mississippi R. Miles.	Elevation. Of divide abv. Lake Superior. Feet.	Elevation. Of Mississippi River at point of junction abv. Lake Superior. Feet.
1.	70	330	648	80
2.	60	200	548	67
3.	50	190	548	67
4.	35	200	468	67
5.	50	250	800	67

It will be noticed that two general routes are proposed, one by the way of the Upper Mississippi River and the other by the way of the St. Croix River and its tributaries. The Mississippi route, No. 1, is the longest of the five. It follows the Mississippi River from St. Paul to Sandy Lake, a distance of 245 miles, rising in that distance 529 ft. East of Sandy Lake is a great marsh, extending to the St. Louis River, and it is claimed that the two rivers could be connected by a few miles of easy dredging. There is then no great change in level until the divide is reached, and from here to Lake Superior the fall is 648 ft. in 70 miles.

The other four routes follow the St. Croix River from the Mississippi River to the Snake River. These four routes all begin at Prescott, Minn., and the rise is 15 ft. for the first 50 miles and 42 ft. for the next two miles. In the next 42 miles 72 ft. more must be ascended to reach the Snake River; and up to this point all the St. Croix River routes are alike. Routes Nos. 2 and 3 follow up the Kettle River, a western branch of the St. Croix River, and cross the divide where it is 548 ft. above Lake Superior. Thence route 3 descends to Superior Bay by the Nemadji River valley, while route 2 crosses to the Knife River Falls on the St. Louis River and descends to Duluth, possibly by the same course as the Mississippi River route. Both routes 2 and 3 terminate at a good lake harbor; but it is stated that there are no available bodies of water for feeding the summit level.

Route 4 is along the Bois Brule River, which empties into Lake Superior a short distance east of the cities of Duluth and Superior. The distance is about the same as by routes 2 and 3, but the summit divide is lower; and from St. Croix Lake, which lies within five miles of the west of the divide, an abundant supply of water is available. There is, however, no good harbor at the mouth of the Bois Brule River. The longest of the St. Croix River routes is route 5, which strikes the lake at the mouth of the White River, east of Ashland, Wis. This route crosses the divide at an elevation of 800 ft. above Lake Superior and can obtain the water for its summit level from Lake Namecagon. In addition to these five routes another route has been suggested as available. This is a modification of the Mississippi route, by which the canal will follow the Rum River valley and the basin of Mille Lacs and thence to Sandy Lake.



ROUTES FOR PROPOSED SHIP CANAL FROM LAKE SUPERIOR TO THE MISSISSIPPI RIVER.

On routes 1, 4 and 5 there seems to be no question but that a sufficient water supply can be obtained for the summit level; but the other two routes are not so well supplied with feeders. On the other hand routes 2 and 3 cross the divide at a lower level and will require fewer locks, besides terminating at a good harbor on Lake Superior. Of course any of the routes would require a very extensive construction of locks.

We are indebted to Fowble & Fitz, Civil Engineers, St. Paul, Minn., for the matter from which the accompanying map and this description have been prepared. The Hon. James Suydam, of the St. Paul Chamber of Commerce, is one of the principal promoters of the proposed canal.

THE T-RAIL TRACK AND STREET PAVING ON THE TERRE HAUTE ELECTRIC RAILWAY.*

Terre Haute is an anomaly among the cities of this country, being the only city that would not permit the girder or grooved rail in its streets. This approval by the public of a T-rail did not exist at the start, but was brought about gradually, assisted by experience. So to-day the Terre Haute road has an all T-rail track, and every block of track in paved streets is so durable that it will last for years, with a minimum of repairs.

The first T-rail track consisted of a 40-lb. T-rail, laid on oak ties, 5 × 7 ins., and 7 ft. long, 3 ft. c. to c. The rails were laid without proper regard to having the end of the rail rest on a tie. Planks 2 × 6 ins., × 12 ft. were laid on both sides of the rail. On the inside the planks were nailed to the ties, and on the outside blocks were nailed to the ties to raise the plank to a level with the rail, to provide vehicles an easy crossing. Ordinary flat splice bars were used with the rails. The rails were bonded with ⅝-in. galvanized bond wire, with a single bond to the joint. They, in turn, were wired and soldered to a ¼-in. supplementary stranded iron wire, each alternate joint being soldered and wired to both rails of the track. The track was covered with good gravel. One year's experience demonstrated that planking was unnecessary and that gravel protected the rails better, in enabling vehicles to pass along the track and to cross it easily and without injury. This substitute only required occasional attention in filling up low spots to maintain a level roadway. In two years the planks were badly decayed and warped up at the end, and as the track was thoroughly overhauled at that time, the planking was taken up, and gravel substituted.

About 1892, when street paving commenced, the Illinois Steel Co. brought out its 60-lb. Shanghai T-rail, and as it was 5¾ ins. high, permitting paving without chairs and direct spiking of the rail to the ties, it was promptly adopted. Selected oak ties 5 × 7 ins., 7 ft. long, were used. After excavating for the track, the ground was rolled by a 14-ton steam road roller. Then 6 ins. of broken stone was placed in position as a bed and rolled. The ties and rails were then placed in position and raised to grade by tamping screened broken stone underneath; spaces between ties were filled with broken stone and rammed to position. Single bonds were used of 7-16-in. galvanized iron wire, and a supplementary wire of No. 00 tinned copper wire.

On top of the broken stone, screened sharp sand was placed, and with a 1-in. hose this sand was washed into the interstices of the stone. After drying, the sand was brought up to an even surface by a fresh deposit, and it was then smoothed to even surface and the desired thickness by a mold board. Then vitrified bricks were placed in position, leaving them somewhat higher than the rail. They were driven into the cushion of sand by means of hand rammers, with a square piece of boiler plate placed on top of them, to force all to the proper level. The sand cushion permitted the bricks to crown evenly from center towards each rail to afford proper drainage. A special brick with one corner cut off with sloping angle to give space for flange of wheel to run in, was laid next to the rail. These bricks were not the shape of the special nose brick now used, and only set against the lower edge of inside of head of rail. The space between the brick and web of rail was filled with grouting. Bricks of regular size were laid between. After the bricks had been rammed and rolled to proper position, a grout of best screened sharp sand and Portland cement with water, made to such flowing consistency as to percolate all the crevices, was poured over them, and by brooms pushed into the openings. A finishing coat of sand was thrown over the entire surface, and traffic was kept off for one week. After thoroughly setting, the sand was swept off and the street opened for traffic. The street between the tracks and curbstone, as well as between the tracks, is one solid mass of concrete and brick from center of

*Abstract of a paper by Russell B. Harrison, read at the convention of the American Street Railway Association at Atlanta, Ga.

street to curb, and will sustain great pressure. Since this track was laid, our experience with it has demonstrated that it could have been improved in one particular, viz., the sand and broken stone should have been united with cement into regular concrete. For we have found since the paving was completed that the use of the water on the sand did not wash it thoroughly into interstices of the broken stone. In time the sand dried and settled down into the spaces, and while the ties and the paving immediately over them have remained firm and solid, the paving between the ties has settled slightly, without breaking or disturbing the concrete holding them together.

Our next experience with T-rail construction was in a street paved with asphalt. The foundation was improved by making it of concrete, 6 ins. below the ties, and also placed between the ties, and up to a point to allow space for 4 ins. of asphalt. The asphalt was brought up to and in contact with the rail on the outside. On the inside of the rail for the first half mile the vitrified brick used on Wabash Ave., with corner cut off on a sloping angle, was used to give flange space, and between the two ends of the brick, asphalt was used in the regular way. On one mile the Haydenville blocks were used inside and outside of the rail, and while they make a smoother finish to the rail than the brick or asphalt, our experience proves that these blocks do not have the wearing qualities of the brick.

Our next experience with T-rail construction was during the year 1893, in several streets paved with brick. The track was as above. The foundation was 6 ins. broken stone concrete below the ties, and about 5½ ins. additional concrete between the ties. It also covered slightly the top of the ties. The foundation for this brick track was further improved by pouring a thin wash of sand and cement over the top of the foundation before placing the sand cushion thereon. Instead of angle-cut brick for flange space, Haydenville blocks were placed on the inside of the rails, 1½ ins. therefrom. The lower part of the space between the block and rail was filled with sand concrete, rammed down tight. On top of this an inch of tar was placed. The hollow spaces in the block were filled with sand concrete before placing in position, and the space in the center of the track between blocks was laid with vitrified brick in the regular way. A year's experience with the Haydenville blocks on these business streets shows that the glazed upper service wears too rapidly, and their use has been entirely discontinued.

While this track, just described, was in every way superior, I gave further study to where additional improvements could be made, causing the following changes: 1, To use a heavier rail with wider head; 2, To substitute metal ties for wood; 3, To secure greater rigidity and evenness in rail ends; 4, A firm and permanent hold on the rails without the use of nuts and bolts; 5, In paving, a better brick and of such chape as would provide better flange room and contact with the web of the rail. These changes brought us to an all-steel T-rail track.

The Illinois Steel Co.'s 72-lb. Shanghai T-rail has been adopted. The rail is 6 ins. high, with 5 ins. base; the head is 2⅝ ins. wide. The long web permits the rail to rest on the ties and brings the top of rail to proper level for paving with brick, asphalt or granite blocks. In this track the rails are laid broken jointed. The wider head gives better contact, and wider bearing service for the wheels. The edges of the wheels do not nick or chip out as with the lighter rails with narrower heads.

Experience with the narrow head rails demonstrates that by wear an outer flange is formed on the wheel and that this outer flange is very destructive to the life of special work and to the wheel. The wider rail head is also better for gravel or macadamized streets, as it gives no opportunity for the stones lying adjacent to the rail to nick the outer edge of the tread of the wheel.

After the necessary excavation the ground was rolled with a 14-ton steam road roller. Then 8 ins. of broken stone concrete was placed in position and allowed to set. Then the rails, ties and joints were distributed and connected together, and the track brought to the required grade by putting blocks under the rails at intervals. Then 4 ins. of concrete is tamped under the ties and under the rails, and the inequalities of the surface are filled with concrete and the whole leveled up with concrete over the top of the ties and pounded to a level surface with a wooden rammer and allowed to set.

The ties are steel, double corrugated, and heavily coated with tar while hot. They are 2 ins. high, 7 ins. wide and 7 ft. long for straight line work, and were laid 15 ins. c. to c. For special work the ties vary in length as the necessities require, up to 20 ft. or more. The metal is ⅛ in. thick. These ties were manufactured by the Daniels Steel Tie Co., of Youngstown, O. The rails are fastened to the ties by clamps with off-sets to fit the base of rail. These clamps are secured and adjusted to the top of the tie by special made bolts with oval shoulder, inserted from bottom of tie, with the head below and the nut on top, a box wrench being used to screw up the nuts.

In using these steel ties in connection with the Wheeler rail joint a mechanical difficulty arose, but was overcome in the following way, after some study: The Wheeler joint has a thickness of 3 ins. below the rail base, and in laying track with broken rail joints a straight tie would not answer. At first we thought it would be necessary to use a wooden tie under rail joints, but by devising a special tie, we were able to have them all of metal. The special steel tie for use under joints was adjusted to the necessary levels, by bending it down in the center 3 ins. by an easy off-set. In laying the track these special ties were easily placed in position and gave perfect satisfaction. The clamps and bolts were the same as on straight line work.

A great deal of attention was given to the subject of securing a good rail joint for this all-steel track, and after examining many devices we selected the Wheeler rail joint made at Marion, Ind., as it did away with the bolts and nuts, and embodied the wedge principle. These joints at that time had not been made for Shanghai rails or for steel ties, but I overcame these difficulties by designing a new joint to be used with these rails and ties, and secured in this new pattern more bearing surface on the tie by having the bottom of the joint made to fit the corrugations of the tie. The joint consists of two parts, one of which is keyed on to the other. The larger or heavier part used on the outside of the rail has two lugs, that fit in the angle joint holes nearest the ends of rails. After it is placed in position, the lighter part is keyed on with a large maul and it holds the rails rigid. Then the tie is placed under joint and is fastened to it in the regular way, with the exception that the clamps have longer off-sets. The holes in the ties for the bolts are also wider apart, on account of the width of the base of the joint. The joint has corrugations on each side at right angles to the rail, which gives it great strength. The joint is made of the best malleable iron and weighs 32 lbs. complete.

Iron bond wire, having proved unserviceable and unsatisfactory, the heaviest copper wire was used in connection with this steel track. Double bonds of No. 0000 copper wire were used at each rail joint, one in the upper and one in the lower part of the web of rail. These bonds were soldered and connected to the No. 00 tinned copper supplementary wire, that has been adopted as standard.

Brick pavement was laid as previously described. As the use of Haydenville block has been abandoned and the angle, nose-cut brick did not touch the web of the rail, I designed a special shaped brick that has many advantages, combined with the same wearing qualities as the brick on each side of the tracks. In the center of each track, at the lowest point in the grade of each street, an 8-in. sewer pipe was laid to the sewer. Over the top or opening of this pipe, in the center of the street, is placed a small catch-basin, surmounted by a special iron grating. The water flowing down the track and along the side of the rails, is thus rapidly removed and a simple and effective drainage secured.

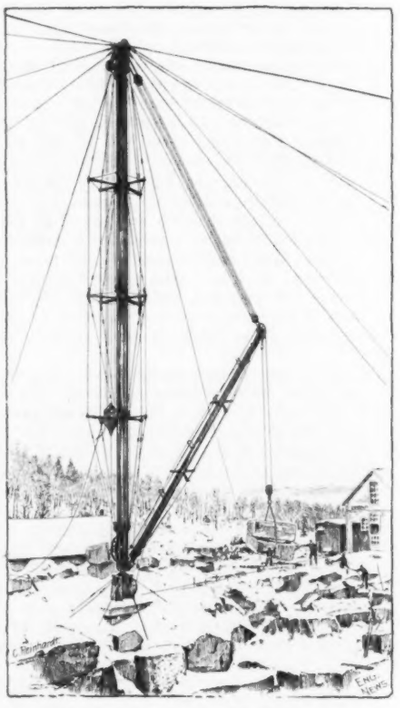
Our track is standard gage, and thus heavily loaded vehicles cannot drive along it and get the benefit of the smooth metallic surface as in the case with girder rails. This condition is a great improvement, and makes a saving in many ways. An ordinance makes it unlawful to drive upon any street or alley paved with wood, stone, brick, or asphalt, any wagon or other vehicle having upon it weight which, together with the weight of the wagon exceeds 4,000 lbs. and is less than 7,000 lbs., unless the tires are at least 3 ins. wide; nor must any such wagon or vehicle having upon it a weight which, together with the weight of the wagon or vehicle exceeds 7,000 lbs., be driven upon any paved street or alley, unless the tires are at least 3½ ins. wide.

A LARGE STEEL DERRICK.

The derrick shown in the accompanying cuts was designed and patented by Mr. Foster Milliken, and was built by Milliken Bros., of New York city, for use in the granite quarry of C. E. Tayntor & Co., at Barre, Vt., where it was delivered and erected in the autumn of 1891. Since then a similar derrick has been furnished by Milliken Bros. to the same concern for use at its shops; but this last derrick is not quite as large as the original one, which is claimed to be the largest derrick in the world. Very heavy monuments and shafts are taken out from this quarry.

The derricks which were in use before this steel one was built had masts and booms made of very large sticks of pine; but the largest that could be procured was not able to raise with safety the heavy loads that occasionally had to be moved in this quarry. It was therefore decided to build a steel derrick, and in designing the work all the latest improvements were adopted.

The mast of this derrick is 99 ft. high and the boom has a radius of 71 ft., so that loads can be lifted anywhere in a circle 142 ft. in diameter, of which the mast is the center. Ten guys are used for the support of the mast, and they are anchored about 200 ft. from the base of the mast in solid rock. The mast and boom are Phoenix columns. The main hoisting rope is 1¼-in. steel wire rope and the main boom fall hoist is ¾-in. diameter, also of steel wire. Over one mile of rope is used in the rigging of this derrick. The total weight of the derrick complete without the ropes is about 50,000 lbs. The mast is trussed in five directions or planes, and the boom is trussed in three planes. To reduce the friction as much as possible, the heel



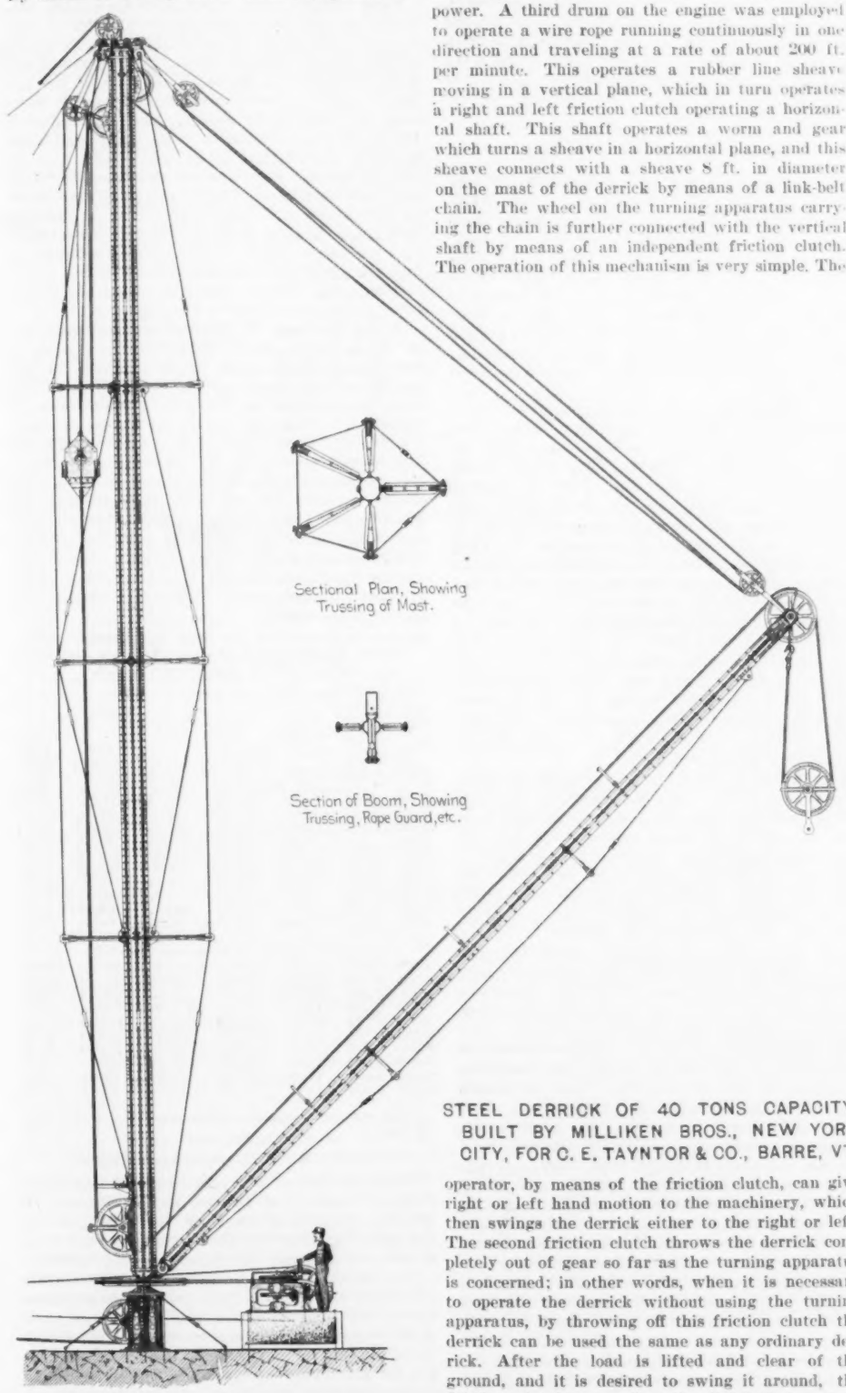
Perspective View of Steel Derrick.

of the mast turns in a cup, which is bushed with phosphor bronze and all the sheaves are bushed with phosphor bronze and turn on steel pins. The head of the mast turns on conical steel rollers. The sheaves are all made as large as possible, so as to turn easily, the sheave at the base of the mast being 4 ft. 4 ins. diameter. The main hoisting rope passes through the foot block and up through the center of the mast to a point near the top, where it passes out over a sheave and between two blocks and falls, making seven parts of rope at this point. The lower block is specially weighted, and from the bottom of this block the rope then passes around the large sheave near the base of the mast and out over the end of the boom. The object of this weighted block on the back of the mast is to save unreeving after a load is lifted. It is necessary, of course, to unwind the rope taken up by the drum of the engine and return the hoisting hook to its original position. Under the old system this was either done by using a very large weight on the end of the fall line or unreeving by hand. In the first case the weight was very unhandy, and was always getting in the way and catching on objects; while the second method was slow and tedious. by having this weighted block the unreeving is done automatically and instantly. The block has guides on the sides, which keep it from turning.

The main boom hoist rope passes over a sheave at the top of the mast and down through the cen-

ter of the mast, and back and forth between a sheave placed on the end of the boom and one at the top of the mast, making five parts of rope at this point. This method of arranging the boom hoist allows the boom to swing entirely round, clear of all obstructions.

By means of a Lidgerwood hoisting engine of 4



STEEL DERRICK OF 40 TONS CAPACITY, BUILT BY MILLIKEN BROS., NEW YORK CITY, FOR C. E. TAYNTOR & CO., BARRE, VT.

tons capacity. 37½ tons were raised 3 ft. 8 ins. in 18½ seconds, the steam pressure being 85 lbs. A test was made by means of a dynamometer on the end of the boom, which showed that when the boom was at right angles with the mast, and carrying a load of 37½ tons,, it only required a pull of 300 lbs. to revolve the derrick. This derrick has been tested with a load of 57½ tons, although it was only designed to carry 40 tons. It is estimated that the derrick itself could be worked with safety to carry loads of 80 tons; but it was decided that the wire rope was not quite equal to this enormous strain. The boom and load may be lifted simultaneously, and the derrick can also be revolved at the same time. A load can be lifted within 10 ft. of the base of the mast, as the boom is designed to go very close to the mast.

In order to further improve the efficiency of this machine, it was decided to revolve the derrick by power. A third drum on the engine was employed to operate a wire rope running continuously in one direction and traveling at a rate of about 200 ft. per minute. This operates a rubber line sheave moving in a vertical plane, which in turn operates a right and left friction clutch operating a horizontal shaft. This shaft operates a worm and gear which turns a sheave in a horizontal plane, and this sheave connects with a sheave 8 ft. in diameter on the mast of the derrick by means of a link-belt chain. The wheel on the turning apparatus carrying the chain is further connected with the vertical shaft by means of an independent friction clutch. The operation of this mechanism is very simple. The operator, by means of the friction clutch, can give right or left hand motion to the machinery, which then swings the derrick either to the right or left. The second friction clutch throws the derrick completely out of gear so far as the turning apparatus is concerned; in other words, when it is necessary to operate the derrick without using the turning apparatus, by throwing off this friction clutch the derrick can be used the same as any ordinary derrick. After the load is lifted and clear of the ground, and it is desired to swing it around, the friction clutch connecting the link-belt is set in place, and the other friction clutch is operated to revolve it either to the right or to the left, as the case may be. In other words, two men, one at the engine and one at the turning apparatus, are able to operate this derrick without the aid of any other person. This is extremely useful where light loads are concerned, and it saves pulling the boom around by hand, which is often a very slow operation in a very deep quarry. The photograph from which our perspective view is made was taken before the turning apparatus above described was put on the derrick.

THE PNEUMATIC DYNAMITE GUN ON THE BRAZILIAN CRUISER "NICTHEROY."

By Lieut. Edward Brinley, Tenente Honorario d'Armada Brazileira, in Charge.

This gun is of 15-in. (38.1 cm.) caliber, and 50 ft. (15.27 m.) in length over all. The construction of the gun and carriage is similar to that of the guns of this type at Sandy Hook, N. J., and Shoeburyness, England, with which the United States and British governments have been experimenting.

The mount consists of a wooden circle, built up from the second deck and braced below, between decks and from the ship frames in the hold, the axis of the trunnions being 4 ft. above the level of the upper deck.

In the center of the woodwork on which the gun is mounted, is a circular hole, through which come the vertical air supply pipe from the accumulators, located in the forehold, and the electric cables.

The central swing joint is located here. This consists of the air-tight swing joint, with the two branch air pipes running from it to the trunnions, and inside and above this the electric swing joint, or sliding contact, with wires running from it to the reversing switch panel and rheostat dial in a box at the port side of the gun and under the forward end of the firing platform.

A heavy cast iron cap fits down over the top of the wooden circle and is bolted to it through flanges inside and outside. Its upper surface is flat and forms the track for the bearing rollers of the gun carriage. Outside, and just below the top of the circle, is a shoulder, with which the holding down clutches of the gun carriage engage. Inside, and about 1 ft. below the top, is bolted, in segments, a circular rack, with which gears the horizontal spur wheel of the training mechanism of the gun.

The carriage is built with double side transoms of box pattern. The electric motor is inside and at the after end of the left side of the carriage, and is thus protected from the weather. The differential oil cylinder, used for holding oil and delivering it to the valve and swing joint packings, is inside the right transom and just abaft the right air pipe leading to the trunnion.

Electricity is the motive force used in manoeuvring the gun, and is supplied by the dynamos located just abaft the engine room on the orlop deck; the wires lead from the reversing switch panel box to the motor. This is a four-pole, direct-current 17-HP. motor, specially built for this work. It is designed to run at 250 revolutions per minute. The initial electro-motive force at the supply is 115 volts. The normal current capacity is 140 amperes, with 240 amperes required for starting. The maximum starting torque is 625 ft.-lbs. The reversing switch panel consists of three concentric copper rings. The two inner ones are unbroken and are connected to the positive and negative sides of the circuit respectively, and are used as distributing points. The outer ring is divided into two equal segments, insulated from each other by sectors of slate. Connections are made on these three rings by means of a wooden arm with copper shoes, the arm being pivoted at the center on a vertical iron shaft, moved from the firing platform by means of a circle keyed on its head. A wooden arm on the same vertical shaft moves a copper shoe over the rheostat dial, which is bolted on the lower side of a slate plate, about 6 ins. below the reversing switch panel in the same box.

The armature shaft of the motor is connected by gearing to a shaft running along the side transom. On this shaft is a worm on a movable sleeve, gearing into the spur wheel of the training gear, the lower wheel gearing into the circular rack previously mentioned. A bevel gear on the forward end of the same shaft turns a horizontal shaft, which is just in rear of the forward transom and at right angles to the line of the gun. On this shaft is a bevel gear on a movable sleeve, which runs a shaft parallel to the center line of the gun. The forward end of this latter shaft is somewhat depressed. Keyed to this shaft is a worm which gears into a segmental rack bolted to lugs on the lower part of the gun, just abaft the trunnions. By a system of levers, controlled from the firing platform, the training and elevating mechanism is thrown in and out of action by means of friction clutches.

These two movements of the gun cannot be given

at the same time. The gun is given first the determined degree of elevation, when the elevating gear is thrown out of action. The training gear being thrown in action, the gun is laid as desired. The forward horizontal shaft extends outside of the right transom and has a squared head. Inside and near the transom it is connected by a bevel gear with a short shaft, which has a bearing in the forward transom and a squared head on the outer end. Levers can be shipped and the gun can be worked by hand by this means. The extreme angle of train is 135° on either beam from ahead, or a total angle of fire of 270°.

The projectiles furnished for this gun were of three sizes, viz.: 15-in. full caliber, 10-in sub-caliber and 8-in. sub-caliber. The first carries a bursting charge of approximately 500 lbs., the total weight of the loaded projectile being 1,000 lbs.; the second, a bursting charge of 200 lbs., the total weight being 500 lbs.; the third, a bursting charge of 100 lbs., the total weight being about 300 lbs. They are made in sections, which are fastened together by countersunk screws passing through shoulders at the ends. Partitions are placed in the middle of certain sections to limit the weight thrown to the rear when the gun is fired and to expedite loading.

The 15-in. projectile carries a gas check near the rear end, held in place by a composition metal ring. The radial gyrating vanes are placed at the end of a heavy iron tube extending from the rear end of the projectile. In the sub-caliber projectiles sabots of wood are placed at the forward and rear ends. The forward sabot is in four pieces, each held in position while in the gun chamber by a composition metal stud, which fits in a socket in a composition metal ring, countersunk in the shell about an inch to the rear of the junction with the head. The force of the air against their forward faces detaches them from the projectile after it leaves the gun. The after sabot is secured to a composition metal ring on the after end of the projectile by metallic elbows. The force of the air breaks these elbows from the ring and the sabot drops from the projectile. Screwed into the rear of the sabot is a piece of iron pipe to keep the rear face of the sabot beyond the air ports. The gas check is on the periphery of this sabot. These gas checks are of leather. The radial gyratory vanes on the sub-caliber projectiles are just forward of the band to which the after sabot is secured.

The fuses used were of the Rapieff pattern, and were constructed to explode either by a head-on or glancing contact with water, the moment of explosion being retarded a short interval of time after the impact of the shell by the use of compressed black powder time trains inside the mechanical fuse. In the case of contact with a solid object, the explosion of the shell is instantaneous.

Off the island of St. Thomas, W. I., on Dec. 1, 1893, this gun was tested. A 10-in. projectile was used. Sail Rock Island was the target. The shell fell beyond the island. The cut-off valve was set for 1,800 yds. No noise of an explosion was heard, and the general opinion aboard the ship was that the fuse did not operate properly and produce a detonation of the dry gun-cotton. The air pressure registered by the manometer at the gun was 1,000 lbs., and all parts worked smoothly.

On May 3, 1894, this gun was again tested off the island of Santa Catharina. A point on Gale Island was the target. Two shells were fired. The first an 8-in sub-caliber, at a range of 4,300 yds., and the second, which was a 10-in. sub-caliber, at a range of 3,700 yds. Both fell within a short distance of the mark. The explosion of each was terrific. I made a change in the fuses used in these projectiles, which, I believe, was the cause of the proper action taking place.

After this experience I felt satisfied that the shell fired at St. Thomas did not explode, and, further, I think that, as delivered by the manufacturing company, the fuses will not cause an explosion. This was the case with the test at Port Royal, S. C., of the gun on the U. S. S. "Vesuvius."

There is a great deal of mechanism about this gun, which requires constant care and attention, and in climates where sweating of the metal is liable to take place, the working parts would have to be removed and examined very frequently. As some of the parts are quite heavy this takes much time. In order to ascertain if all the packings are tight, air pressure must be put on the gun. Again, although every part may be found in good order when tested, at the critical moment one of the packings may develop a leak.

The range of this gun is not sufficient to prevent ships with heavy guns doing all the damage they may desire. A gun of this type, unless placed on a heavily armored vessel and entirely protected, would be liable to be rendered useless by the heavier rapid-fire guns before any use could be made of it. If a slow burning powder were made which could be used in firing shells charged with gun-cotton from long guns, the range could be increased and the gun much simplified.

MARKING STREET LINES.

In discussing a paper upon this subject, read by Mr. C. M. Broomall at the annual convention of the American Society of Civil Engineers (Eng. News, June 7), Mr. Horace Andrews, City Engineer of Albany, N. Y., gives some very useful points. Mr. Broomall, in his paper, describes the various methods of marking in use in a number of American cities. With one exception, all these marks were surface marks. Mr. Andrews advocates underground marks as the most desirable. He has found such marks in an excellent condition after 20 years.

For regular city monuments Mr. Andrews uses a double-hubbed extra-heavy 5-ft. length of 3-in. cast iron soil pipe well tarred and weighing about 50 lbs. Into the hub of this is leaded a 4-in. brass cap 1½ ins. thick and centered. These 3-in. monuments, including brass cap, cost $1.95 each in lots of 50. He lays especial stress upon the manner in which the hole is dug for these monuments. They should be of small diameter, made with a post-hole auger or with a crowbar and the spoon shovel used by telegraph linemen. If the soil is loose, and the trouble and expense can be afforded, the monuments are made much more stable by filling around them with concrete, a plan now adopted on the New York State Survey. If a long trench is made, the monument is very liable to lean, in time, in the direction of the long axis of the trench. It is thus very desirable to dig the holes with tools adapted to making a small, deep hole.

It is difficult to adhere to rigid rules for the location of monuments, says Mr. Andrews. In suburban localities, with the houses built well back from the street, the street corner is the best and most convenient place. In other places a monument can be set near a corner, on one street line and 3 to 5 ft. from the other; in this position the instrument can be set directly over the monument and will sight past the porches of houses. At too great a distance from the corner and with sewers, gas and water pipes laid under the sidewalks, the monuments are liable to be disturbed. The center line of the street seems to be the location most liable to disturbance.

To mark traverse points in old cities where the traffic is great and there is considerable possibility of disturbance, Mr. Andrews commends the method adopted by Mr. Gerke for use in Altenberg, Germany. Mr. Gerke summarizes the requirements of such a monument as follows: Durable, solid material, not liable to danger from frost or decay; security, but an easily found surface mark; mark itself not buried, and adapted to holding a sighting pole; a surrounding case to guard against danger from repaving or disturbance, and capable of lateral or vertical shifting without affecting the mark.

To accomplish all this, Mr. Gerke used a cast iron pin 23.6 ins. long and 3.15 ins. square on top and 1.57 ins. square immediately above the point. This pin has a rounded top, with a tapering hole, about 1.2 ins. in diameter and 6.7 ins. deep, to receive the sighting pole. These pins weighed 31 lbs. each and were driven into the paved streets with their tops from 6 to 8 ins. below the street surface. A small octagonal iron box, with lid held on by lugs and requiring a key to open it, is placed over the pin. The top of the box is flush with the pavement, with this pavement resting on a flange on the side of the box, and holding it down. The box weighs 36.3 lbs., and box and pin together cost about $1.10, in Germany. The tops of these pins serve also as subordinate bench marks. German bench marks of importance are usually round-headed bolts cemented into holes drilled into the walls of houses, etc. For absolute security Mr. Andrews thinks that an initial datum should be referred to not less than three bench marks, as described by Mr. G. W. Cooley in Trans. Am. Soc. C. E. for 1889.

TESTS OF 45-IN. AND 42-IN. NEW AMERICAN TURBINES AT HOLYOKE, MASS.

Some turbine tests which showed a high efficiency at part gate were made in July, of this year, in the testing flume of the Holyoke Water Power Co., at Holyoke, Mass. The reports of the tests are signed by Messrs. E. S. Waters, the hydraulic engineer for the company, and A. F. Sickman, the engineer in charge. The turbines were 45 and 42 ins. in diameter, respectively, and were made by the Dayton Globe Iron Works Co., of Dayton, O., well known as the makers of the "New American" turbines. The wheels tested were samples of a new and improved pattern of turbines which this company is now putting on the market. In its design a chief object has been to secure a high efficiency when running at from half to three-fourths gate. This is especially important where turbines are to be used to drive dynamos.

During the tests, 37 observations were made on the 45-in. and 33 on the 42-in. wheel, a number of observations being made at each change in the opening of the speed gate. The results of the tests are presented in the accompanying table in condensed form, the figures for the highest and lowest efficiency observed at each opening being given and all others omitted. All the observations were for periods of either three or four minutes. It should be stated that the range of efficiency in the last two stages of lowering the 45-in. turbine's gate do not tell the story fairly, for with the gate at 0.382 the next to the lowest efficiency was 76.5% against 72.82% for the minimum, and with the gate at 0.293 the corresponding figures were 71.42% and 60.67%, respectively.

Results of Tests of 45 and 42-in. New American Turbines in Testing Flume of Holyoke Water Power Co.

45-in Turbine, Tested July 9, 1894.

Proportional part of— Full opening speed gate.	Full discharge of wheel.*	Actual head, ft.	Revolutions per minute.	Cu. ft. water per sec.	Developed horse power.	Per cent. efficiency.
1.000	0.907	16.06	119.17	141.58	205.27	79.76
1.000	1.022	15.98	103.50	144.87	205.05	78.26
0.699	0.885	16.42	122.00	127.18	195.19	82.58
0.699	0.921	16.30	101.25	131.77	195.08	80.25
0.505	0.775	16.78	117.33	112.60	175.74	82.18
0.505	0.746	16.85	127.40	108.50	164.80	79.64
0.382	0.671	17.03	111.83	98.12	149.99	79.31
0.382	0.621	17.24	136.25	91.40	129.87	72.82
0.293	0.563	16.88	113.67	82.07	118.40	75.52
0.293	0.521	17.04	145.50	76.19	89.15	60.67

42-in Turbine, Tested July 14, 1894.

1.000	0.999	16.33	128.00	134.18	199.56	80.50
1.000	1.014	16.39	116.25	136.40	200.24	79.17
0.710	0.893	16.56	134.80	120.85	188.14	83.09
0.710	0.916	16.43	112.25	123.38	184.18	80.31
0.504	0.774	16.59	129.33	104.85	162.89	82.77
0.504	0.736	16.77	141.75	100.20	149.58	78.68
0.389	0.674	17.13	125.25	92.76	142 40	79.21
0.389	0.633	17.25	144.50	87.44	127.89	74.94
0.230	0.509	17.48	121.00	70.80	98.85	70.60
0.230	0.494	17.51	136.20	68.73	92.73	68.10

* Per cent. of discharge of full gate when giving best efficiency.

THE U. S. GEOLOGICAL SURVEY.

From an address delivered before the Colorado Scientific Society, of Denver, by Mr. Charles D. Walcott, Director of the U. S. Geological Survey, the following notes are taken referring to the work done and the history of this government bureau:

The present United States geological survey began active operations in July, 1879, under the direction of Mr. Clarence King. Prominence was given to investigating the mineral resources of the Rocky Mountain region in Colorado, Utah and Nevada; but its operations were practically limited to the states and territories of the West. In 1882 authority was issued for the making of a geologic map of the whole United States, and a more comprehensive policy was necessary. The new plan included a topographic map of the United States, as a basis for the geological work. Since 1882 the scope of the bureau has gradually widened; geologic work was continued in the Western mining districts; many broad geologic problems had to be studied before the geologic mapping could be done with economy and accuracy, and with the preparation of topographic maps, areal geology was grad-

WEATHER TABLE FOR SEPTEMBER, 1894. (Furnished to Engineering News by the Department of Agriculture.

	Stations.	Temperature. (Deg. Fahr.)				Wind.			Precipitation—rain or melted snow—inches.		
						Velocity in miles per hour.		Direction at time of max. velocity.			
		Average.	Max.	Min.	Range.	Average.	Max.		Total.	Heaviest in 24 hours.	No. of rainy days.
Northern Cities.	Northfield, Vt.	59.0	85	25	60	7.0	36	SW	2.99	1.18	9
	Portland, Me.	60.3	88	38	50	6.0	28	SE	2.76	1.45	11
	New York, N. Y.	69.8	94	46	48	9.5	36	SW	8.04	4.75	11
	Pittsburg, Pa.	70.4	92	43	49	5.8	27	W	3.68	1.42	11
	Chicago, Ill.	66.2	90	44	46	16.0	48	S	8.28	3.35	11
	Omaha, Neb.	67.2	90	38	52	8.1	32	SE	2.48	1.13	8
	St. Paul, Minn.	63.8	94	37	57	8.3	32	SW	1.82	.82	4
	Duluth, Minn.	59.8	94	37	57	6.3	26	NW	2.08	.74	6
	Bismarck, N. Dak.	57.9	94	26	68	10.5	59	NW	3.83	3.67	4
	Average.	63.8	91	37	54	8.6	36		4.00	2.06	8
Southern Cities.	Washington, D. C.	71.4	95	47	48	5.6	27	NW	1.53	1.05	9
	Louisville, Ky.	73.0	96	44	52	6.7	21	NW	2.64	.72	7
	St. Louis, Mo.	70.8	94	48	46	9.8	40	SW	3.11	1.07	9
	Savannah, Ga.	77.2	96	59	37	8.3	48	NE	6.88	3.72	14
	Kansas City, Mo.	69.1	93	44	49	8.0	29	SE	7.14	3.93	11
	Jacksonville, Fla.	78.6	96	62	34	7.8	48	NW	16.63	9.86	18
	Chattanooga, Tenn.	73.8	89	53	36	5.4	27	NW	1.67	1.12	6
	New Orleans, La.	79.9	90	66	24	6.6	28	SE	0.92	.36	7
	Memphis, Tenn.	74.7	93	50	43	6.1	26	NW	1.60	.70	7
	Palestine, Tex.	76.8	95	56	39	4.7	23	SE	10.04	4.63	9
	Average.	74.5	94	53	41	6.9	32		5.32	2.72	10
Western Cities.	Helena, Mont.	54.0	80	31	49	8.0	45	SW	1.42	.80	13
	Port Angeles, Wash.	53.4	76	40	36	4.6	24	W	2.60	.65	15
	San Francisco, Cal.	63.4	94	49	45	12.0	38	SW	1.05	1.04	2
	Salt Lake City, Utah	61.0	85	37	48	6.1	38	SW	2.87	1.01	9
	Santa Fe, N. Mex.	59.0	80	36	44	6.5	36	SE	0.87	.34	4
	Denver, Colo.	62.6	88	37	51	6.9	35	NE	1.55	1.44	4
	Yuma, Ariz.	83.3	109	50	59	5.6	33	NW	0.51	.51	1
	Average.	62.4	87	40	47	7.1	36		1.55	.83	7

ually taken up, until, in 1894, more than three-fourths of the available geologic force was employed in this work.

During the surveys of King, Hayden, Powell and Wheeler, between 1867 and 1879, the bulk of the work was of a general, or reconnaissance, nature. In Colorado, Hayden gave the broad facts of geology and indicated localities where minerals were reported. This was useful at that time; but to-day accurate detailed maps and thoroughly scientific work is demanded by the modern mining engineer. The first topographic maps of the United States were on a scale of four miles to the inch, and many Western States and territories were so mapped and published. Now the public demands better and more detailed maps, and a scale of two miles, and in many cases of one mile, to the inch is used, with 25-ft. contours for the more detailed work.

There has been a more steady development of methods since the beginning, and within the past two years the Survey has been making better maps than ever before. On the basis that the state pays one-half the cost of the work, the government has been pushing its surveys within the boundaries of the states of Massachusetts, Rhode Island, Connecticut, New York and New Jersey; and all the States mentioned, except New York, now have complete topographic maps. In the semi-arid region these maps are wanted to aid in the development of artesian waters and irrigation water supply.

Areal geology, here referred to, represents all that can be ascertained relating to the various rocks within the limits of an atlas sheet. This information is platted on the topographic sheets and shows the character of the rocks; whether of igneous or sedimentary origin, mineral-bearing, or otherwise; with the cross structural sections and underground geology, as far as it is possible to ascertain this. In connection with this work, which is eminently useful, the last Congress appropriated a sum of money to be expended in gaging the streams and determining the water supply of the United States, including the investigation of underground currents and artesian wells in the arid and semi-arid regions. The geology of highways, or the study of clays suitable for brickmaking and of road materials, in general, is another important field upon which the geological survey has recently entered.

To date, the U. S. Geological Survey has made topographical maps of over 600,000 sq. miles of the territory of the United States; and of this at least 500,000 sq. miles are available for geological work. Sixty different parties are now in the field working under an appropriation of $298,000 for the present fiscal year.

The so-called Gohna Lake, formed by a landslip some months ago, in the Hurdwar district, in India, broke its bounds on Sept. 17, but without the great catastrophe expected. The eastern bank had been slowly weakened by percolation, and between midnight and dawn the 300 ft. of water confined by the mass passed off down the valley of Hurdwar. It rose in a narrow gorge below to a height of 100 ft. and the flood carried with it trees, building materials and dead animals. It swept away the suspension bridges at Deoprayag and Lachman Gula, and rose 60 ft. at the town of Srinagar, leaving nothing behind it but two temples, filled with mud. "The Indian Engineer" says there was no loss of life reported, as the government had maintained a corps of watchers and put up a temporary telegraph line to give notice of the final break, and all the inhabitants in the valley below were long ago sent to the hills.

Brooklyn is one of the few cities in the country which continues the use of cement pipe for sewers in preference to vitrified. The pipe if well made is probably as strong or stronger than the vitrified, but is more porous and thus gives readier access to ground water. In a combined system, however, this is not a matter of much importance. The smaller sizes of cement pipe are more expensive than the corresponding sizes of vitrified pipe. The larger sizes, however, can be made at a profit for a considerably lower figure.

Budapest is to have an electric underground railway two miles long. The Hungarian Minister of Commerce has lately granted the line a concession, under which it is to be completed by April 1, 1896.

Ageing brandy by electricity is one of the latest applications of the serviceable fluid. According to a report lately made to the Brandy Distillers' Company of London, by its manager, ozonized compressed air applied to the spirits while it is under the influence of an electrical current will enable the company to dispose of its product at advantageous prices only 18 months after distillation.

A new tire for bicycle wheels is proposed by M. Gerard, Chief Engineer of the city of Bordeaux, and by a M. Picon. It is intended as a substitute for the pneumatic, and to obviate the dangers of rupture of the air chamber, disarrangement of valves, etc. The new tire is essentially a rubber tube of moderate thickness, with transverse rubber disks inside at short distances apart. These disks are slightly thinner at the center than on the edges and are firmly cemented to the tire, thus leaving a number of independent air spaces inside the tire. It is said that the new tire can be applied to existing machines with ease and at little cost.

A cableway for passenger service has been built across the gorge called the Devil's Dyke, near Brighton, England. The stations are 1,100 ft. apart. The two cars are suspended from carriers running on a track rope, and are hauled by an endless cable driven by a Crossley oil engine.

Plans are asked from the architects of all nations for building a museum of Egyptian antiquities at Cairo. The cost of the building is limited to $600,000, and the prizes offered for the best five plans are $3,000 for the first prize, and a like sum to be divided among the other four. All projects must reach Cairo on or before March 1, 1895. Fuller details may be obtained by addressing Mr. Frederick C. Penfield, U. S. Consul, Cairo, Egypt.

CONSTRUCTION NEWS.

RAILWAYS.

East of Chicago—Existing Roads.

BUFFALO, ATTICA & ARCADE.—The incorporation of this company was noted last week. S. S. Bullis, Pres., Olean, N. Y., writes us as follows concerning the road: The route of the road is the old Attica & Freedom R. R., extending from Attica south through the county of Wyoming to Freedom, N. Y. We are rebuilding the road as a standard gage from Attica to Arcade, 26 miles, expecting to complete the work and open it as a standard gage line by Dec. 15 of this year. The grade of this road was built in 1852-53, with 12-ft. banks and in a first-class manner for a 3-ft. gage railway. The ties were put upon the road and it was all built ready for the rails as far south as Arcade, under the name of the Attica & Allegheny Valley R. R. Some work was done south of that point, but no part of it was completed, and the work at that time was virtually abandoned without laying any rails south of Attica. In 1871 a corporation was organized to go on with the work under the name of the Attica & Arcade R. R., but practically nothing was done. In 1881 the parties interested in the Erie narrow gage systems laid a narrow gage track on this line, extending it south to Cuba and from there through the oil regions of Pennsylvania, but only operated the whole line for a short time, abandoning the road south of Sandusky in a few months. This part of the road has been operated as a narrow gage road since that date, until by foreclosure sale it was closed out to the Continental Trust Co. in March of this year. I purchased the property from this Trust company and have organized a new company. We have already placed in the roadbed 35,000 ties, rebuilt the trestles and are now laying 65-lb. rails upon the roadbed. We are doing the work ourselves and have no contracts to let at present. The filling of the trestles will require some 40,000 yds. of earth and will have our attention at an early date. The other officers of the company are: C. V. Merrick, of Bradford, Pa., Vice-Pres., Treas. and Secy.; G. W. Conklin, of Attica, N. Y., Gen. Supt.

CINCINNATI, GEORGETOWN & PORTSMOUTH.—The directors have decided to extend this railway to West Union, O., and the construction will be commenced within a few days, according to Cincinnati papers.

CINCINNATI, JACKSON & MACKINAW.—A proposition has been submitted to the city of Jackson, Mich., for an extension of this railway from Addison, Lenawee county, to that city, a distance of 22 miles. Several routes for such an extension were surveyed several years ago. Gen. Man., F. B. Drake, Toledo, O.

CLEARFIELD, CONEMAUGH & WESTERN.—S. J. M. McConnell, Pres., Harrisburg, Pa., writes us that surveys have been completed from Porter's to Irvona, the right of way nearly all secured, and that the contract for the construction and equipment of this part of the line is now in process of negotiation, as noted in our issue of last week. The projected length of the line is 75 miles. Ch. Engr., Samuel Brugger.

FORT PLAIN & RICHFIELD SPRINGS.—This railway, noted last week, is being built by the Richfield Construction Co. The total length is 30 miles. Ch. Engr., R. B. Wicks, Fort Plain, N. Y.

ST. JOSEPH VALLEY.—In our issue of Oct. 18, under Street and Electric Railways, we gave the officers of a company that was reported as planning to build a railway from Buchanan, Mich., to Benton Harbor. It is now reported that the construction has been commenced and that the company has acquired this road, which was built several years ago from Buchanan to Berrien Springs, 10 miles, and will rebuild it and extend it to Benton Harbor, 18 miles. Under the name of Benton Harbor & Southeastern it is proposed to build from Buchanan, Mich., to Napanee, Ind., about 40 miles. Pres., F. E. Lee, Dowagiac, Mich.

YORK SOUTHERN.—The Pennsylvania portion of the Baltimore & Lehigh road, extending from York, Pa., to Baltimore, Md., was purchased recently by Warren F. Walworth and a new company organized under the above name; capital stock, $600,000; Pres., W. F. Walworth; Treas., Chas. C. Frick; Secy., Geo. W. Rupp. It is proposed to make the line standard gage and build branches to coal fields in Pennsylvania.

Projects and Surveys.

EAST STROUDSBURG & MATAMORAS.—Incorporated in Pennsylvania to build a steam railway about 40 miles in length through Monroe and Pike counties; capital stock, $400,000; Pres., Simeon Friedberger, Reading Terminal, Philadelphia; directors, Jos. Gibson, W. A. Wixson, C. V. Grant, G. H. Lang, J. S. Potsdamse, Emil Reizenstein, and Ellicott Fisher, all of Philadelphia, Pa.

SOUND SHORE.—Incorporated in New Jersey to build a railway in Union and Middlesex counties; capital stock, $250,000; incorporators, J. R. Maxwell, Brooklyn, N. Y.; Geo. F. Baker, J. W. Watson, New York; S. M. Williams, H. P. Baldwin, Roselle, N. J.; S. Knox, Elizabeth, N. J.; Geo. O. Waterman, Red Bank, N. J.

WADDINGTON, CANTON & SOUTHERN.—This company was authorized in September to build a railway from Canton to Waddington, N. Y., 20 miles, and it is stated that the contracts for the construction and equipment have all been awarded, the work to be commenced this week and be completed in 60 days. Treas., H. E. Seaver, Canton, N. Y.

Southern—Existing Roads.

CHATTANOOGA SOUTHERN.—Gordon Frank, Jacksonville, Ala., who has the contract for a 4-mile extension of this railway to Round Mountain, Ala., has commenced work with about 200 men.

FLORENCE NORTHERN.—The purchase of this railway by Neely, Smith & Co., Chattanooga, Tenn., was noted in our issue of Oct. 11. The property has been sold by Neely, Smith & Co., to L. C. Garrett and associates, of Chicago. The transfer of the property is conditioned on the purchasers commencing work in good faith by Nov. 1, and finishing the road within a year. The road is projected to extend from Florence, Ala., to Linden, Tenn., a distance of about 80 miles, and 30 miles have been graded. The construction contract was held by Neely, Smith & Co. It is likely

that the purchasers intend building and using this road in combination with other lines.

CUYLER & WOODBURN.—The incorporation of this railway was noted last week. The line extends from Meidrim, Ga., to Woodburn, 14 miles, and is all graded and ready for the rails, which have been purchased from Smith & Kilby Co., Anniston, Ala. From Culyer to Medrim two miles, the company will use the track of the Savannah, Americus & Montgomery. The chief promoter of the road is said to be J. N. Wood, of Greig, Jones & Wood, Savannah, and Wood & Co., Pineora, Ga., large turpentine dealers. J. L. Fleming and F. T. Lockhart, of Augusta, Ga., are also interested.

Northwest—Existing Roads.

CHICAGO & NORTHWESTERN.—The Green Bay, Wis., "Gazette," states that T. J. McGrath, of McGrath & Anderson, has left for Quinnesee where the firm has secured the contract for the building of a 4-mile stretch of track for this railway. He took with him eight teams of horses and several carloads of working utensils.

MINNEAPOLIS & ST. LOUIS.—Representatives of this railway are negotiating for right of way through Mankato, Minn., for an extension to connect with the Wisconsin, Minnesota & Pacific. It is reported that the line will be built in the spring.

CHICAGO, PADUCAH & MEMPHIS.—B. F. Johnston, Gen. Man., is reported as stating that he has made financial arrangements for the completion of this road to a connection with the Wabash at Altamont, Ill.; also, that he has just placed the order for the rails for this line with the Illinois Steel Co.; that the grading and bridging are progressing satisfactorily, and that he expects the line to be completed from Altamont to Marion, Ill., by Jan. 1.

WINONA & WESTERN.—Incorporated in Minnesota Oct. 26, as a reorganization of the Winona & Southwestern; capital stock, $2,000,000; incorporators, H. W. Lamberton, V. Simpson, M. G. Norton, S. S. Youmans, and R. D. Cone, all of Winona, Minn. The Winona & Southwestern is projected from Winona, Minn., to Omaha, Neb., 380 miles, and the line has been in operation from Winona to Osage, Ia., 114.4 miles, for three years. A receiver was appointed in November, 1893.

Southwest—Existing Roads.

GEORGETOWN & GRANGER.—The construction of this railway from Georgetown to Granger, Tex., has been commenced. Steps are being taken to consolidate with the Trinity, Cameron & Texas.

GULF & INTERSTATE.—This company has been granted permission to issue bonds not to exceed $10,000 per mile for the first 70 miles of its road from Port Bolivar, Galveston county, Tex., to Beaumont, Jefferson county. The Texas railroad commission found that the road is now in progress of construction, about 30 miles having been graded; that it has acquired grounds for depot buildings, for shops, yards and other terminal facilities, and that the route has been surveyed and located. Representatives of the company are now in London for the purpose of placing the bonds. L. P. Featherstone, Secy., Galveston, Tex., states that about half a mile of grading is done a day, and as soon as the bonds are negotiated the construction will be pushed rapidly.

SHERMAN, SHREVEPORT & SOUTHERN.—It is reported that the construction of the extension from Jefferson, Tex., to Shreveport, La., 45 miles, will be commenced in the spring. This is a part of the Missouri, Kansas & Texas system.

SAN ANTONIO & GULF SHORE.—The 60-lb. steel rails for the first 10 miles of this railway are being delivered at San Antonio, Tex. Some 30 miles of roadbed is completed and three bridges on the line are now in process of construction. The company has filed a mortgage on the road as fast as it is built, at the rate of $12,000 per mile, to the Farmers' Loan & Trust Co., of New York. The road is to be about 200 miles in length.

Foreign.

MEXICO.—A press report states that arrangements have been made for the immediate resumption of work on the construction of the extension of the Mexican International from Monclova to Sierra Mojada, and that the Monterey & Mexican Gulf is also to be extended from Trevino to Sierra Mojada, and thence to the Port of Mazatlan on the Pacific coast. The contract for the construction work has already been let, and the surveys for both of these extensions were completed and approved by the government two years ago.

STREET AND ELECTRIC RAILWAYS.

MANCHESTER, N. H.—It is reported that an electric railway will soon be constructed in this city, and contracts for cars, motors, etc., will be let before Jan. 1. The road will cost, when equipped, $150,000 to $200,000. The power house will cost $75,000. J. H. Heckford, Electrical Engr., Salem, Mass., has been in the city several weeks looking over the ground.

BENNINGTON, VT.—The legisature has been petitioned for a charter for an electric railway from this village to connect with the Hoosick, N. Y., Electric Ry., and for a charter for the Bennington & Woodford electric railway to Woodford, Glastenburg, Somerset, Searsburg, Dover and Wilmington.

SOUTHINGTON, CONN.—It is reported that L. V. Walkley, New York, who has purchased the controlling interest in the Southington & Plantsville Electric Ry., proposes to at once negotiate with the owners of the New Britain Electric system to extend their road to the Southington line, two miles south of Plainville; also for an extension of the Meriden electric road to the Southington line, 1½ miles.

BATAVIA, N. Y.—Press reports state that a practical demonstration of the feasibility of the Beecher single track electric road, which it is proposed shall run from Batavia to Lake Ontario, will soon be given by M. H. Johnson, of the electrical firm of Nightingale & Johnson, Utica. A corporation has been formed under the name of the Equipment Construction Co., with the following directors: M. H. Johnson, Lina Beecher, Batavia; C. A. Seaver, Batavia; J. W. Holmes, Batavia, and T. P. Nightingale, Utica; capital stock, $10,000. The trial will be had at Waterport, and if everything proves satisfactory steps will be taken towards the construction of the road.—J. H. Ahern, New York, is making arrangements for an electric railway from this city to Le Roy, a distance of ten miles, besides a branch to Horseshoe Lake. It is proposed to have a capital stock of $200,000.

LONG BEACH, N. Y.—It is proposed by the Long Beach Association to construct an electric railway from Point Lookout to Hicks' beach.

CAMDEN, N.J.—The West Jersey Traction Co. has been granted a franchise.—The New York & Philadelphia Traction Co. has petitioned for a franchise.

IRVINGTON, N. J.—The North Jersey St. R. R. Co. and the New York & Philadelphia Traction Co. have petitioned for franchises for electric railways. W. L. Johnson and E. C. Hine are interested in the latter company and H. M. Barrett in the former.

MAPLEWOOD, N. J.—The Maplewood & South Orange Ry. Co. has been granted a franchise by the South Orange trustees for an electric railway, which must be completed in six months.

ALLEGHENY, PA.—The Spring Hill Electric Ry. Co. has secured $27,000 in subscriptions to aid in the construction of its line. William Ahlers is interested.

ALLENTOWN, PA.—Efforts are being made to build an electric railway from Reading to this place.

BRIDGEPORT, PA.—The Philadelphia & Rosemont Passenger Ry. Co. has petitioned for a franchise to construct an electric railway on De Kalb St.

BALTIMORE, MD.—The Pikesville & Emory Grove Electric Ry. Co. is discussing a plan for extending its line to Gettysburg. Vice-Pres. and Gen. Man., G. R. Webb; J. H. Wilson, Fowblesburg, Md.; J. H. Beckley, Beckleyville, Md.; T. J. Sisk, Hampstead, Md.; J. E. Masenhimer, Monroe, Ind., and O. W. Garrett, Pleasant Hill, Pa.

CARBONDALE, PA.—William Walker, Mayfield, and S. S. Jones, Carbondale, are interested in the construction of an electric railway between Oneonta and Richfield Springs.

CHARLESTON, S. C.—Julian Fishburne has been granted a franchise for an electric railway, work to be commenced within 90 days.

ATHENS, GA.—Messrs. Holman, Carithers, Hunnicutt and Dearing are to apply for a charter to incorporate the Athens Electric Ry. Co.

COLUMBUS, O.—The West Mound St. & Harrisburg Electric R. R. Co. has about completed arrangements for constructing the line to Harrisburg. Efforts are being made to build to Mount Sterling. J. M. Briggs, Grove City, is interested.

DAYTON, O.—The Cincinnati, Middletown & Dayton Traction Co. is making surveys for an electric railway. Pres., H. B. Morehead; Ch. Engr., W. P. Noble. H. Hafer and C. Jenkins are the contractors who are reported as to build the first section between Cincinnati and Hamilton.

GLENDALE, O.—The construction of an electric railway to connect Hartwell, Lockland and Reading is being discussed. C. C. Richardson, Mayor, is interested.

NEWARK, O.—A company recently incorporated to construct an electric railway between Columbus and Buckeye Lake has petitioned the Licking county commissioners for a franchise, which provides that all bridges in Licking county over which the road will pass will be built and kept in repair by the company; that the road will be built of 45-lb. T-rails and will be at least 18 ft. from the center of the highway, and that one power house is to be built at Hebron, the other near Columbus. G. L. Converse, D. C. Jones and Charles Simonson, Columbus, are interested.

WESTWOOD, O.—The council is discussing granting a franchise to a street railway company which proposes to construct a railway from either this place or Cheviot to the harvest home, and subsequently to Bridgetown and Dent.

BRAZIL, IND.—An electric railway company has been incorporated to construct a line to Terre Haute; capital stock, $16,000; Max Joseph and R. J. Smith have secured the right of way.

DETROIT, MICH.—The Mount Clemens & Lake Side Electric Ry. & Dock Co. has been incorporated with a capital stock of $25,000. B. B. Coursin is interested.

COLORADO SPRINGS, COLO.—It is reported that the Denver & Rio Grande R. R. Co. is considering a proposition for changing the branch line to Manitou into an electric line, with the power station at Colorado City.

PASADENA, CAL.—The council has granted a franchise to L. P. Hansen for an electric railway.

SAN JOSE, CAL.—The San Jose & Santa Clara R. R. Co. has petitioned the council for a franchise to extend its electric line. Vice-Pres., J. P. Burke.

NEW WESTMINSTER, B. C.—Bids are asked until Nov. 24 for the purchase of the Westminster & Vancouver Tramway Co.'s electric line. G. E. Corbould.

HIGHWAYS.

MONTANA.—Bids are asked until Nov. 10 for building a road 12 ft. wide around Bad Rock. Jas. Burke, County Clk., Missoula.

WASHINGTON.—The Business Men's Association of Everett has appointed a committee of five to investigate the advisability of constructing a road on Ebey Island, leading into Everett.

OREGON.—It is reported that Gilliam county is receiving bids for building a road from the Burns bridge over Thirty-mile Creek to Condon, a distance of 30 miles.

CALIFORNIA.—The construction of a road from Redlands to Highlands is being discussed; estimated cost, $3,000 to $15,000.

BRIDGES.

BATH, ME.—Bids are asked until Nov. 6 for a 97-ft. iron span 20-ft. wide for the Merrymeeting Bay bridge. Also for the removal of a 41-ft. span from one part of the bridge to another; also for the building of 36 ft. of solid roadway at its east end; all work to be completed by March 15, 1895. Jos. M. Hayes, Clk.

BOSTON, MASS.—The city engineer in his annual report recommends that extensive repairs be made on the Berkeley St. structure over the tracks of the consolidated railroad, the Broadway bridge over Fort Point Channel, Charles River Bridge, the Chelsea Bridge (north), Congress St. bridge, Mt. Washington Ave. bridge and the West Boston bridge. The report also says that most of the draws in the city need attention.

PHILADELPHIA, PA.—Jas. H. Windrim, Dir. Pub. Wks., has awarded the contract for a bridge on the line of 17th St. to the Mills Construction Co., at $36,362; time, four months.—The "Press" states that the bureau of surveys is engaged preparing plans for a new bridge at Gray's Ferry, to cost about $800,000. The bridge will be a double-decked structure, built of steel and the expense of the construction will be shared equally by the city and the Pennsylvania R. R. Co. The new bridge will be built to conform with the approaches of the streets, and will be slightly removed from the old line. C. A. Trik, Supt. City Bridges, states that the present structure at Gray's Ferry is the worst and most unsafe bridge in the city.

DAYTON, O.—The following bids were received for a hoist bridge at Warren St., the bridge to have a 38-ft. roadway and two 8-ft. sidewalks: Toledo Bridge Co., $13,300; extra masonry, $4 per cu. yd.; Youngstown Bridge Co., $13,250; extra masonry, $5 per cu. yd.; King Bridge Co., $11,796, $12,900, $11,900; extra masonry, $4 per cu. yd.; Rogers Iron Co., Springfield, $12,800; extra masonry, $4 per cu. yd.

TOLEDO, O.—It is reported that the Cincinnati, Hamilton & Dayton R. R. Co. will soon build a new bridge across the Maumee River in this city.

LEAVENWORTH, KAN.—A railway bridge on the Burlington road at Sugar Lake, a few miles above this city, was burned Oct. 25.

ST. JOSEPH, MO.—A new iron bridge on the Kansas City, St. Joseph & Council Bluffs R. R., between Waldron and Parkville, was carried away by high water Oct. 19.

HOUSTON, TEX.—Bids are asked until Nov. 26 for the construction of a bridge across Buffalo Bayou at the foot of Factory St. John T. Browne, Mayor.

WATER-WORKS.

BOWDOINHAM, ME.—It is reported that works will probably be put in by another season.

EAST CANDIA, N. H.—The citizens have purchased two hose wagons and are reported about to secure a supply for fire protection.

BARRE, MASS.—The contract for works has been awarded to John E. McClellan, Grafton, Mass., the pipe to be furnished by the Warren Foundry & Machine Co. Geo. W. Cook, of the Barre Water Co., writes that the other bidders for the construction were E. R. Cheney, Boston; Long & Little, Athol; Frank L. Allen, Worcester; F. B. Drieschbach, New London, Conn.; L. A. Taylor, Worcester, and John D. Shepper, Holliston.

BOSTON, MASS.—The contract for building an addition to the Mystic pumping station, with engine and boiler foundations, has been awarded to Mack & Moore, at $10,900, the other bidders being T. S. Brown, $13,657; D. J. McKim, $13,000; John Moyle, $10,900.

BRAINTREE, MASS.—John Scollard, Secy. Bd., writes us that the whole matter of extensions has been postponed until spring.

CAMBRIDGE, MASS.—The contract for building the Payson Park reservoir, at Belmont, has been awarded to R. A. Malone, Lancaster, Pa. The bids were noted in our issue of Oct. 4. L. M. Hastings, Cy. Engr.

PEABODY, MASS.—Last spring $500 was appropriated for plans and estimates for securing a supply from Suantang Lake, Lynnfield, and the question is now being investigated. It is thought that an 18-in. conduit would cost about $125,000.

JOHNSTOWN, N. Y.—Bids are asked by the water commissioners until Nov. 19 for constructing a cast iron conduit with appurtenances and reservoir, the work including 30,400 ft. of 16-in. pipe, 144 ft. of 24-in. pipe, 300 ft. of 8-in. pipe, 9 16-in. gates, 6 8-in. gates, 1 24-in. gate, 2,128 cu. yds. rock excavation, 2,600 cu. yds. embankment, 760 cu. yds. masonry, 100 cu. yds. concrete, etc.

LONG ISLAND CITY, N. Y.—The Long Island R. R. Co. is laying a 12-in. main, along the railway tracks from Jamaica to this city to secure a supply for its own use, and the use of several large manufacturing concerns that wish to avoid the present water tax, according to press reports. It is stated that an extensive plant will be constructed between Jamaica and Dunton, and a reservoir built at Hunter's Point. A 2,000,000-gallon daily supply will be obtained from artesian wells.

MIDDLEBURG, N. Y.—It is reported that the village will pay $700 a year for 30 hydrants. The incorporation of the Middleburg Water Co. was noted Oct. 18, and the construction of the works was commenced this week.

MONROE, N. Y.—An election will be held Nov. 10 to vote on the construction of works estimated to cost $34,000; plans prepared by Potter & Folwell, New York; supply by gravity from a lake. Henry Mapes, Pres. Trustees.

PAWLING, N. Y.—It is stated that an election will soon be held to vote on the question of works.

ROCHESTER, N. Y.—Bids are asked until Nov. 9 for trenching and pipelaying, as stated in our advertising columns. Thos. J. Neville, Clk. Comrs.

SCHENECTADY, N. Y.—The city is considering a supply from two wells, from which it is reported that 12,000,000 gallons of pure water is being pumped daily. A reservoir at an elevation of 265 to 300 ft. would be constructed near the wells. It is stated that the commissioners will soon ask for $300,000 for the work.

CAMDEN, N. J.—The committee has found that an artesian supply can be secured at a cost less than the expense of filtering the river water.

JERSEY CITY, N. J.—O. W. Barnes and B. S. Church, of New York, have been engaged as experts to pass on the specifications for a new supply; Mr. Barnes to report to the water commissioners and Mr. Church to the board of finance, according to press reports.

ALLEGHENY, PA.—It is expected that bids will be asked this week for the pumping engines for the new works.

ARCHBALD, PA.—The Archbald Water Co. has awarded the contract for a reservoir to M. Cawley.

BEAVER FALLS, PA.—The opening of bids for a filter plant for the new works has been indefinitely postponed. As soon as a date for receiving new bids has been decided upon the work will be readvertised in Engineering News. The contract for the reservoir has been awarded to Allen & Co., Wampum. The itemized bids were published last week. Engrs., James H. Harlow & Co., Pittsburg.

CANONSBURG, PA.—A company proposing to furnish this place, Morganza, Houstonville and Washington with water from the Monongahela River has offered to give the borough 40 fire plugs for $1,000 per year, including free water for public buildings. The council has offered $900 per year for 40 plugs, with free water for flushing sewers and for public school buildings.

GALETON, PA.—The Galeton Water Co. has been incorporated with a capital stock of $8,000; Treas., Nelson L. Allen.

HALIFAX, PA.—There is talk of constructing works in this place.

LATROBE, PA.—L. W. Fogg, Borough Engr., writes us that an election will be held Nov. 6 to vote on the question of works, including pumping plant at wells, 1,500,000-gallon reservoir and nine miles of pipe.

LEBANON, PA.—The council has passed an ordinance for a daily supply of 2,000,000 gallons from the Swatara Creek, at an estimated cost of $50,000.

MAHAFFEY, PA.—The citizens have voted in favor of works.

OIL CITY, PA.—The water board has recommended the purchase of a 3,000,000 to 5,000,000-gallon pump.

RANKIN, PA.—W. H. Gordon, Clk., writes us that the borough has completed a pipe system, and is negotiating with the Pennsylvania Water Co. for a water supply.

TANEYTOWN, MD.—Dr. Geo. T. Motter, Chn. Com., writes us that a committee has been appointed to secure plans and estimates for works, which will probably be put in by a private company; supply from creek; population, 700.

NORFOLK, VA.—The committee has requested the commissioners to correspond with competent engineers to ascertain the cost of the various supplies on the north side of Elizabeth River. R. Y. Zachary, Supt.

ELIZABETH CITY, N. C.—C. C. Allen, Cy. Clk., writes us that a committee has been appointed, but no other steps have yet been taken for works.

ABBEVILLE, GA.—J. D. Lawson, Clk. Council, writes us that $20,000 in bonds have been voted for works, but nothing further can be done until after the legislature meets this month.

CUTHBERT, GA.—Surveys for works are being made by M. F. Sullivan, of Mable & Sullivan, Atlanta.

LEXINGTON, KY.—S. A. Charles, Engr. and Receiver, writes us that a contract has been practically let for a new filter plant estimated to cost $25,000.

PADUCAH, KY.—It is reported that an election will soon be held to vote on the water-works proposition.

CLEVELAND, O.—Bids are asked until Nov. 12 for an independent air pump and jet condenser. J. H. Farley, Dir. Pub. Wks.——Plans are being made for extensions and improvements to cost about $1,000,000. The work will include new pumping stations and a new 4-mile tunnel.

COLUMBIANA, O.—An election will be held Nov. 3 to vote on an issue of $30,000 in bonds for works, for which E. J. Millar, Steubenville, O., is preparing plans. E. L. Roning, Jr., Cy. Clk.

LORAIN, O.—The city council has voted to issue $40,000 in bonds for extensions, including a new crib 2,200 ft. in length, suction pipe, settling well and about two miles of 12-in. mains.

CARROLLTON, IND.—The citizens are agitating the question of works, according to reports.

CENTERVILLE, MICH.—There is talk of purchasing a 3,000-bbl. tank and windmill and putting in works.

GRAND RAPIDS, MICH.—The board of works is considering the purchase of a new pumping engine.

MONROE, MICH.—Bids are asked until Nov. 26 for furnishing a supply for public purposes for year beginning Jan. 1. Works were built here in 1880 by the Monroe Water Co. John Steiner, Cy. Clk.

NILES, MICH.—J. H. Synon & Co., of Chicago, have been awarded the contract for putting in the new works at $75,695. There will be nine miles of 12 to 4-in. mains, and water will be pumped to a 24 × 100-ft. stand-pipe. The Michigan Brass & Iron Works, Detroit, Mich., will furnish 140 hydrants and about 150 valves. Engr., Geo. W. Sturtevant, Jr., Chicago.

CHICAGO, ILL.—Bids are asked until Nov. 8 for laying mains in nine streets. H. J. Jones, Comr. Pub. Wks.

NOKOMIS, ILL.—The contract for works has been awarded to Chas. Tobin, Hillsboro, Ill.

OHIO, ILL.—Bids will soon be asked for laying mains and erecting a water tower; city now has well and steam pump. Chas. Abraham, Cy. Clk.

OSWEGO, ILL.—Bids are asked until Nov. 5 for constructing works, including steel tower 60 ft. high, with 2,000-bbl. tank, pump-house, pump and gasoline engine. Engr., J. F. Richardson, Jr., Ottawa, Ill. G. H. Voss, Cy. Clk.

GRAYVILLE, ILL.—J. A. Hoelzl, Cy. Clk., writes us that no contract for works will be awarded until spring.

SIDELL, ILL.—Wm. Lyons, Pres. Trustees, writes us that works will probably not be put in this year; population, 1,000.

STAUNTON, ILL.—The contract for works was awarded in August to G. Siegel, Carlinsville, Ill., and the works will be completed next month. Works include an artificial lake, two Deane pumps, 25,300 ft. of 8 to 4-in. mains, 14 hydrants, 16 × 36-ft. steel tank on a brick tower 70 ft. high; supply from well 21 ft. deep. Engr., F. Wm. Raeder, St. Louis.

VANDALIA, ILL.—Hiram Phillips, Consult. Engr., St. Louis, writes us that the following bids were received for constructing works: Geo. C. Morgan, Chicago, $46,400, complete; C. A. Stoaky, Belleville, Ill., $42,320, complete; $29,600, without stand-pipe and filter; Fremont Hill, Chicago, $36,500 and $29,500, or $32,000 for a complete plant, cash basis; R. S. Colman, St. Louis, $35,000 for complete plant, cash basis.

VIRGINIA, ILL.—F. Wm. Raeder, Consult. Engr., St. Louis, is preparing plans for works. Address the committee of ways and means.

WAUKEGAN, ILL.—Henry Thatcher, Cy. Clk., informs us that the contract for laying mains, etc., as recently noted, has been awarded to Snyder & Williams, Dayton, O., at $22,430, the other bids being Casgrain & McDonald, $23,079; C. & T. Inglehart, $23,092; John Healey, $22,988; Samuel I. Pope & Co., $24,749; C. E. Gray, $24,412; Wm. Wright and Joe Blahs, $25,907; N. J. Gaylord, $22,500; Gregory, Reed & Co., $23,871; Wm. Hallowell, $23,769.

CLINTON, WIS.—The citizens have voted to issue $13,000 in bonds for works.

ELKHORN, WIS.—The village board has contracted with F. M. Gray, of the Gray Water Supply Co., Milwaukee, for an artesian well, according to reports, as a preliminary step toward putting in works.

LA CROSSE, WIS.—The council has voted in favor of issuing $75,000 in bonds for extensions, including a 10,000,000-gallon pumping engine, 20-in. main and 30-in. intake, for which plans are being prepared. Wm. Lohmiller, Chn. Com. Consult. Engr., John A. Cole, Chicago.

LODI, WIS.—S. H. Watson, Village Clk., writes us that the contract for works has been awarded to F. A. Headson & Co., Wausau, Wis., at $10,900.

TOMAH, WIS.—The Stillwell-Bierce & Smith-Vaile Co. has been awarded the contract for two 750,000-gallon pumping engines for the new works.

DUBUQUE, IA.—The city engineer is reported as in favor of new works for fire, boiler and street sprinkling purposes, and of using the present works only for domestic purposes.

HULL, IA.—Bids are asked until Nov. 15 for the erection of a brick tower with tank. N. G. O. Coad, Mayor, wrote us Oct. 15 that nothing would be done for works before next year. B. H. Tamplin, Recdr.

JESUP, IA.—Efforts are being made to put in works, supply from a spring four miles south of the town.

MOVILLE, IA.—The citizens have voted to issue bonds for works.

POSTVILLE, IA.—The contract for works has been awarded to Monteith, Dempsey & Homer, Dubuque, at $8,553.

SIOUX CITY, IA.—Bids are asked until Nov. 6 for constructing works for Morning Side, as advertised in our issue of Oct. 18 (postponement of date from Oct. 23).—The Sioux City & Morning Side Water-Works Co. has been incorporated by J. J. Roche, E. C. Peters, W. F. Beam and others; capital stock, $100,000.

SUMNER, IA.—Bids will soon be asked for constructing works. Frank Wescott, Recdr.

DULUTH, MINN.—At the election Oct. 26 the citizens voted in favor of purchasing the works and issuing additional bonds for $600,000 for extensions, as noted elsewhere in this issue.

ELYSIAN, MINN.—C. F. Johnson, Pres. Council, writes us that the contract for works has been awarded to the U. S. Wind Engine & Pump Co., Batavia, Ill., at $4,130. Fairbanks, Morse & Co., St. Paul, bid $4,225, and Edmund T. Sykes, Minneapolis, $4,210.

NEW PAYNESVILLE, MINN.—Bids are asked until Dec. 20 for the purchase of $5,000 in water bonds. A. T. Watson, Recdr.

ZUMBROTA, MINN.—The contract for works has been awarded to H. A. Olson & Co., Stillwater, at $4,456.

GOTHENBURG, NEB.—The citizens have voted to issue $10,000 in bonds for works.

CHILLICOTHE, MO.—The water-works and electric light plant will be sold at auction Dec. 6.

GLASGOW, MO.—We are informed that the works are nearly completed. They were designed by F. Wm. Raeder, Consult. Engr., St. Louis, and the contract for the construction was let in September to Jaeger & Blanchard, Rich Hill, at $7,000. Works include a 500,000-gallon swinging suction end pump placed in a pit (bricked) 30 ft. deep, 8 and 6-in. mains and a 36,000-gallon Louisiana cypress tank.

MARCELINE, MO.—Hiram Loug, Deputy Clk., writes us that the Santa Fe R. R. Co. has offered to furnish a supply if the city will put in a system of pipes, but no action has yet been taken by the council.

FORT WORTH, TEX.—J. B. Hawley, Consult. Engr., has reported in favor of a reservoir, dam, etc., estimated to cost $134,000. The committee has recommended the universal adoption of the meter system, construction of masonry dams and selection of a mechanical filter. J. G. Clements, Chn.

HILLSBORO, TEX.—The council has voted to issue $15,000 in bonds for works; supply will be pumped from artesian well to stand-pipe. Engr., D. A. Poyer, Dallas.

McKINNEY, TEX.—J. W. Waddill, Clk., writes us that no steps are being taken now for putting in works.

COLORADO SPRINGS, COLO.—The contract for the construction of the Pike View reservoir has been awarded to Thos. Ord, the other bidders being Straw & Gideon, Clough & Anderson and David McShane, all of Colorado Springs.

DENVER, COLO.—The Denver Union Water Co. has been incorporated with a capital stock of $7,500,000 to consolidate the American Water Co., Denver City Water Co., Denver Irrigation & Water Co., and the Domestic, Beaver Brook & Mountain Water Co.; Pres., W. S. Cheeseman; Treas., D. H. Moffat.

OAKESDALE, WASH.—J. W. Johnson, Cy. Clk., writes us that the city has been enjoined from issuing $28,000 in bonds for works and electric lights, and the question is now before the courts.

RITZVILLE, WASH.—It is reported that works are being put in.

BAKER CITY, ORE.—J. L. Baisley, J. S. Hinshaw and C. H. Stuller have reported to the council that gravity works will cost $65,000.

SAN FRANCISCO, CAL.—The Stanislaus & San Joaquin Water Co. has been incorporated by Henry E. Simmons, Summit, N. J.; Chas. H. Leadbetter, Albert L. Bancroft, A. R. Cotton, this city, and Chas. H. Leadbetter, Jr., San Jose, Cal.; capital stock, $1,500,000.

ST. JOHN, N. B.—Efforts are being made by the residents on Mt. Pleasant to secure a water supply and sewers, at an estimated cost of $10,000.

ARNPRIOR, ONT.—The Perry Co., Ottawa, has offered to put in works to cost $38,700, if the town will pay $1,000 a year for 37 hydrants.

VICTORIA, B. C.—It is reported that the city engineer has been directed to prepare plans for filter beds with a capacity of 3,000,000 gallons per day.

IRRIGATION.

BROKEN BOW, NEB.—The citizens of West Union and Sargent townships, Custer county, voted Oct. 23 to issue $14,500 in bonds to aid in the construction of a ditch 50 miles long and which will irrigate 50,000 acres.

COLUMBUS, NEB.—Orlando Nelson has filed papers for water right for an irrigating ditch from Loup River through Platte and Colfax counties.

SAN BERNARDINO, CAL.—The Citrus Belt Irrigation District has been granted permission to construct a ditch from Base Line and Lytle Creek diagonally to Riverside Ave., several miles west of this city. The ditch is to be 20,000 ft. long, and have a carrying capacity of 1,000 ins., and be of cement work. The water is to be taken from Lytle Creek.

NEW COMPANIES.—Platte River Irrigation Co., Lexington, Neb.; $5,000; W. F. Hill, J. A. Tyler, J. F. Lambson, G. B. Darr, G. C. Crandall.——Stewart Fruit Co., Bakersfield, Cal.; $153,600; to sink wells, operate and build water-works, and distribute water for irrigation; J. S. Carroll, Oakland; C. M. Simpson, Pasadena; Colin Stewart, Baltimore, Md.; J. B. Voshurg, Alameda.——Big Four Nursery Co., Bakersfield, Cal.; $50,000; to sink wells, develop water-works and distribute water; R. Frisells, C. B. Wright, E. J. Rockwell, D. C. Pennington, Bakersfield.——Santa Catarina Island Co., Los Angeles, Cal.; $500,000; to build water-works for irrigation and domestic use; William Banning, J. B. Banning.——Honey Lake Irrigation Co., San Francisco, Cal.; $1,000,000; A. L. Bancroft, C. H. Leadbetter, A. R. Colton, San Francisco; B. H. Bancroft, Walnut Creek; H. E. Simmons, Summit.

SEWERS.

HUDSON, MASS.—The construction of a system continues to be agitated.

MELROSE, MASS.—Bids are asked until Nov. 7 for the purchase of $25,000 of 30-year 4% sewer bonds. George Newhall, Town Treas.

TAUNTON, MASS.—E. A. Tetlow, Cy. Clk., writes us that his mail has been crowded with letters addressed to him as city engineer, owing to the news item in our issue of Oct. 18. Geo. A. King is city engineer and inquiries as to the contemplated sewers should be addressed to him.

VALLEY FALLS, R. I.—The construction of a system for this village, Lonsdale, Berkeley and Ashton will probably be discussed at the next town meeting.

TERRYVILLE, CONN.—It is reported that the construction of a system is about to be begun.

WINDSOR LOCKS, CONN.—J. E. Egan has been making surveys for a system. A town meeting will soon be held to discuss the subject.

BROOKLYN, N. Y.—Bids are asked until Nov. 8 for rebuilding a 30-in. sewer in Nassau Ave. between Lorimer and North 15th Sts. A. T. White, Comr. Cy. Wks.

BUFFALO, N. Y.—The board of public works has awarded the contract for a sewer in Wyoming Ave. to John Mumm, of this city, at $3,345.

MASPETH, N. Y.—Public meetings are being held to discuss the question of sewers.

NEW YORK, N. Y.—The following contracts have been awarded for constructing sewers: Joseph Moore, Bungay St. sewers, $68,873; A. M. Newton, Longwood Ave. sewer, $62,375.

ROCHESTER, N. Y.—The lowest bid for constructing a sewer in University Ave. was that of William Fuller at $9,767; engineer's estimate, $13,000. Contracts have been awarded to the following: Hawley St. pipe sewer, William Fuller, $1,001; Alphonso St. pipe sewer, James Holohan, $1,901.——Bids are asked until Nov. 7 for six pipe sewers. Thos. J. Neville, Clk.

HOBOKEN, N. J.—T. F. McCann, Cy. Surv., has completed plans for an outlet sewer in Perry St., estimated to cost about $100,000. The work was authorized by the legislature two years ago, and it is reported that bids will soon be asked for the construction.

JERSEY CITY, N. J.—Bids are asked until Nov. 7 for constructing 840 ft. of 24-in. brick sewer in St. Paul's Ave. The work will include about 500 cu. yds. of rock excavation. G. T. Bouton, Clk.

TRENTON, N. J.—Bids are asked until Nov. 7 for constructing a sewer in Cummings Ave. C. E. Murray, Cy. Clk.

WOODBURY, N. J.—D. T. Mathers, Cy. Clk., writes us that plans for a system have been prepared by Waring, Chapman & Farquhar, but that it is doubtful if any construction will be done this year.

TUNKHANNOCK, PA.—The construction of sewers is being urged.

WARREN, O.—Bids are asked until Nov. 23 for constructing about 10,000 ft. of 24 to 9-in. pipe sewers; average cut, 9 ft. A. E. Andrews, Cy. Clk.——The city clerk informs us that the following bids were received for constructing 1,893 ft. of 20-in. and 2,248 ft. of 15-in. sewers recently advertised.

McGuigan & Fisher, Meadville, Pa.	$4,506
Campbell Bros., Cleveland, O.	3,440
James McGlashin, Warren, O.	4,111
G. J. Vetter, Youngstown, O.	4,340
Toledo Construction Co., Toledo, O.	2,972
W. B. Connell, Youngstown, O.	3,900
James Connelly, Cleveland, O.	3,650
Harry J. Poff, Warren, O.	5,858
J. W. Kelley, New Brighton, Pa.	3,562
F. E. Gribben, Youngstown, O.	3,407
J. C. Smyth, Pittsburg, Pa.	3,849
C. O. Donnell, Youngstown, O.	3,356
Robert Bell, Warren, O.	3,407
R. Henderson, Youngstown, O.	3,062
McDowell & McCracken, Cleveland, O.	3,804
S. S. Wight, Defiance, O.	3,678
J. C. Murray, Newark, O.	3,354

WASHINGTON, D. C.—The Potomac Terra Cotta Co. has been awarded the contract to furnish 24 to 10-in. sewer pipe and Y branches of various sizes, and

Thomas Somerville & Son the contract for 8 and 6-in. sewer pipe and 6-in. bends. The itemized bids were published under Contract Prices in our issue of Oct 18.

AKRON, O.—Bids are asked for furnishing sewer pipe for two years from Nov. 15. F. C. Wilson, Clk. Bd. Cy. Comrs.

COLUMBUS, O.—Bids are asked until Nov. 7 for constructing sewers in district No. 3. J. A. Fanning, Clk. Bd. Pub Wks.

IRONTON, O.—Bids are asked until Nov. 7 for constructing 8 to 6-in. pipe sewers in four streets. G. H. Davies, Cy. Clk.

INDIANAPOLIS, IND.—The city engineer has completed plans for a 42 to 10-in. sewer, 6,340 ft. long, to extend through five streets, and plans are now being prepared for the White River intercepting sewer, to be 54 to 36 ins. in diameter. The latter plans will not be completed for about two months.

SOUTH BEND, IND.—Bids are asked until Nov. 12 for constructing pipe sewers. L. A. Hull, Cy. Clk.

PEKIN, ILL.—We are informed that a complete survey for a system has been made, and that plans will be prepared during the coming months. It is probable that some construction will be done next year, but how much has not been decided. Consult. Engr., J. A. Harmon, Peoria; J. C. Aydelott, Cy. Engr.

DES MOINES, IA.—The board of public works has received the following bids for constructing the Capital Park sewer system: P. McDonald, $1.13½ per lin. ft.; Fleming & Co., $1.29½; King & Kennedy, $1.13; W. M. Wright & Co., $1.29; H. A. King, 99 cts.; Kavanagh & O'Connell, $1.07; Bryan & Youngerman, $1.07; B. B. Rourk, $1.27; John Hurley & Co., $1.34; J. F. Hanrahan, $1.23½.

FORT DODGE, IA.—Bids are asked until Nov. 10 for constructing 18 and 10-in. pipe sewers in five districts. D. A. Weller, Cy. Clk.

BENSON, MINN.—The citizens have voted to issue bonds for the purpose of constructing a system.

ST. PAUL, MINN.—Bids are asked until Nov. 5 for constructing a sewer in South Robert St. J. C. Mueller, Clk. Bd. Pub. Wks.

KANSAS CITY, MO.—The Central Sewer Pipe Co. has been incorporated with a capital stock of $20,000; incorporators, W. S. Dickey, Johnson Martin and J. C. Martin, Jr.

ST. LOUIS, MO.—Bids are asked by the board of public improvements until Nov. 9 for constructing sewers in district No. 16.

ONTARIO, CAL.—The council has adopted the engineer's report recommending an expenditure of $9,000 for a system.

STREETS.

BOSTON, MASS.—The contract for constructing a telford macadam roadway in St. Germain St., from Massachusetts Ave. to Dalton St., has been awarded to Quimby & Ferguson, at $4,916. The other bidders were: Pierce F. Lonergan & Co., $6,011; H. Gore & Co., $6,180; and Frank J. Hughes, $4,985.

NEW YORK, N. Y.—Bids are asked by the department of public works until Nov. 5 for paving portions of two streets with asphalt on concrete.

HOBOKEN, N. J.—The following bids have been received for improving 23d St.: H. M. Schneider, $6,098; B. Feeney, $7,770; Callery & Murphy, $7,288; P. J. Curtin, $7,642; P. H. Flaherty, $7,666; A. W. Roelker, $8,116.

WASHINGTON, D. C.—The district commissioners have adopted a list of 52 streets to be paved at an estimated cost of about $392,000.——Bids are asked by the district commissioners until Nov. 6 for grading, macadamizing and regulating streets.

WAYCROSS, GA.—The council will petition the legislature to amend the city's charter so as to authorize the council to condemn land for laying out, widening, extending and otherwise improving the streets.

DAYTON, O.—Bids are asked until Nov. 21 for 9,300 sq. yds. of paving with Medina blocks, brick, asphalt blocks or sheet asphalt. C. A. Herbig, Cy. Comptroller.

TIFFIN, O.—Bids are asked until Nov. 10 for macadamizing Clinton Ave. Jeremiah Rex, Cy. Clk.

INDIANAPOLIS, IND.—It is proposed to pave two streets with asphalt at an estimated cost of $10,957.

TERRE HAUTE, IND.—Bids are asked until Nov. 20 for paving with asphalt. C. H. Goodwin, Cy. Clk.

DULUTH, MINN.—The board of public works has received the following bids for paving Fifth Ave, between Second and Fourth Sts.; specifications calling for either concrete curb or the Parkhurst combined curb and gutter:

	Concrete.	Parkhurst.
E. J. Emery	$5,709	$.....
John Clyne	5,921	.....
M. C. Burke	6,085	.....
M. Fitzgerald	5,981	6,414
J. D. O'Connell	6,222	6,222
P. McDonnell	.....	6,046
L. C. Meining	6,670	6,700
Fredin & Wilson	6,360	.....

MUSCATINE, IA.—Bids are asked until Nov. 6 for paving a portion of Walnut St. with brick. D. T. Eaton, Cy. Comptroller.

OMAHA, NEB.—The bids for 38,000 sq. yds. of asphalt paving in Sherman Ave. have all been rejected, and it is reported that the board of public works will readvertise the work. The bids are noted under Contract Prices.

HOUSTON, TEX.—Bids are asked until Nov. 12 for constructing brick, stone or cement sidewalks in 17 streets, and until Nov. 5 for sidewalks in two streets. J. T. Browne, Mayor.

MONTREAL, QUE.—The council has passed ordinances for constructing sidewalks in two streets, estimated to cost $21,027, and for macadamizing portions of ten streets, estimated to cost about $55,000.

ELECTRIC LIGHT AND POWER.

BROOKLYN, N. Y.—The contract for an electric plant for lighting the Brooklyn Bridge cars has been awarded to the Electrical & Mechanical Engineering & Trading Co., at $18,135 for the plant and $1,350 a year for maintenance. The General Electric Co. bid $18,560 for plant. There will be ten lights of 16 c. p. in each of the 60 cars.

CAPE MAY, N. J.—It is reported that an electric light plant to cost $50,000 is to be constructed at once. J. B. Taylor, Supt. Franklin Electric Light Co.; L. M. Bullitt, Philadelphia, and F. J. Meivin, Cape May, are interested.

RUTHERFORD, N. J.—The council has awarded the contract for lighting the borough for one year to the Rutherford, Boiling Springs & Carlstadt Electric Co., at $18 for each incandescent lamp of 25 c. p.

ROCKPORT, MD.—The Rockport Water-Works Co. is reported as to extend its plant so as to furnish power for lighting the streets by electricity.

PORT HURON, MICH.—An election will be held Nov. 6 to vote on the question of issuing $40,000 in bonds for constructing or purchasing an electric light plant. W. F. Wagenseir, Cy. Clk.

MANITOWOC, WIS.—The advisability of establishing a municipal electric light plant is being investigated by a committee. G. G. Sedgwick is interested.

MINNEAPOLIS, MINN.—The Minneapolis General Electric Co. has taken out a permit to erect a two-story electric light station, to cost $20,000.

GOLDEN CITY, MO.—The question of electric lights is being considered.

HARRISONVILLE, MO.—It is reported that an electric light plant is to be established at this place.

HAMILTON, ONT.—Briggs & Lewis, Toronto, have made application for an act to incorporate the Hamilton & Lake Erie Power Co. for the purpose of acquiring the right of way and to construct a water course from some point on Lake Erie at or near Drummondville to Hamilton, through the counties of Haldimand, Lincoln and Wentworth, and for the purpose of building electrical works for the generation of electricity for light, heat, power and other purposes.

REGINA, ASSINIBOIA.—The Regina Electric Light & Power Co.'s plant is to be sold at auction Dec. 19 by Alexander Shepphard. There are at present 700 incandescent lights running. The company has about nine miles of wire, with all necessary poles, cross-arms, pin tops, transformers and latest model of cut outs. One "National" 750-light dynamo. One Brown engine, 150 HP., and one Westinghouse engine, 75 HP.

NEW COMPANIES.—Polar Star Electric Co., Faribault, Minn.; $50,000; Jas. Hunter, J. F. Hughes.——Cleveland Springs Land & Hotel Co., Camden, N. J.; $150,000; to construct and operate electric plants for lighting and power; G. F. MacRae, C. C. Eckert, Philadelphia; L. C. Parker, Merchanville, N. J.——American International Electric Co., Hawthorne, N. J.; $200,000; to manufacture electric machinery and appliances; H. B. Oakman, F. A. Bellevue, Brooklyn, N. Y.; G. A. Ghekas, New York; F. M. Ashley, Hawthorne, N. J.——American Safety Heat, Light & Power Co., Baltimore, Md.; $50,000; R. D. Bradley, Joseph Knell, G. L. Rogers.——Maryland Safety Heat, Light & Power Co., Baltimore; H. C. Barranger, E. C. Wollman, G. W. Knell.——Westlake Electrical Mfg. Co., East St. Louis, Ill.; $100,000; C. T. Westlake, David Biggs, C. T. C. Collins.——Pacific Electric Co., Pacific, Mo.; $5,020; W. E. Bailey, Kofpitz; W. B. Smith.——Stanley-Kelley-Chesney Specialty Co., Pittsfield, Mass.; $125,000; to manufacture small motors and electrical machinery; W. B. Tobey.——Franklin Illuminating Co., Sea Cliff, N. Y.; Pres., D. W. Pardee, Brooklyn; Secy., F. J. Cole, Sea Cliff; Treas., John Graham, Sea Cliff.——Mount Gilead Electric Light & Power Co., Mount Gilead, O.; $15,000; E. F. Bowen, M. J. Cormack, H. F. Fishack.——F. P. Electric Co. Chicago, Ill.; $500,000; E. I. N. Frost, C. W. McCorkle.——Cambridge Electric Light Co., Cambridge, Ill.; $12,000; D. D. Lamb, Henry White.——Attleborough Steam & Electric Co., Attleborough, Mass.; $65,000; Pres., W. A. Walton; Treas., W. H. Haskell.——American Heat, Light & Power Co., Nashua, N. H.; $1,000,000; E. B. Towne, C. E. Wright, Oscar Clifford.——Appleton Gas Light & Fuel Co., Appleton, Wis.; $40,000; George McMillan, W. S. Cargill.——Tennock Electric Light Co., Detroit, Mich.; $1,000,000; F. R. Richmond; W. R. King, A. C. Graham.——Anchor Electric Co., Portland, Me.; $75,000; Pres., H. C. Hawks, Boston; Treas., P. M. Reynolds, Milton, Mass.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

DREDGING.—Philadelphia, Pa.—Bids are asked until Nov. 20 for dredging in Salem River, N. J. Maj. C. W. Raymond, U. S. Engr. Office.

DREDGING, ETC.—Toronto, Ont.—Bids are asked until Nov. 8 for dredging, filling and bridge foundation at the Island Park. John Hallam, Chn. Park Comrs.

NAVAL SUPPLIES.—Washington, D. C.—Bids are asked until Nov. 10 for supplies at the Norfolk and New York navy yards. Edwin Stewart, Paymaster Gen., U. S. A.

ELEVATORS.—Minneapolis, Minn.—Bids are asked by the court house and city hall commissioners until Nov. 5 for vertical hydraulic or electric elevators. Archs., Long & Kees, Kasota Bldg.

RIVER IMPROVEMENTS.—Ottawa, Ont.—Bids are asked until Nov. 23 for the improvement of the Lower Narrows of the Ottawa River, above Pembroke. E. F. E. Roy, Secy. Dept. Pub. Wks.

BUILDINGS, ETC.—Washington, D. C.—Bids are asked until Dec. 10 for the erection of buildings at naval magazine, Mare Island, Cal. W. T. Sampson, Ch. of Bureau of Ordnance, Navy Dept.

BUOYS, ETC.—Tompkinsville, N. Y.—Bids are asked until Nov. 6 for buoys and appendages and mooring chains for the year ending June 30, 1895. Capt. W. S. Schley, U. S. Lighthouse Inspector.

PUBLIC BUILDING.—Camden, Ark.—Bids are asked until Nov. 27 for the construction of a U. S. public building in this city. Address Chas. E. Kemper, Acting Supervising Arch., Treasury Dept., Washington, D. C.

BREWERY.—Buffalo, N. Y.—August Esenwein, Arch., will receive bids for the interior construction of the new brewery now in the process of erection at Depew. It will require a considerable amount of iron work. The estimated cost of the interior work is $20,000.

HOTEL EXTENSION.—Buffalo, N. Y.—August Esenwein, Arch., is preparing plans for a $40,000 addition to be built to the International Hotel at Niagara Falls. The work will require a large amount of iron, for which Mr. Esenwein will furnish plans and specifications on application.

REBUILDING PIERS.—St. Catharines, Ont.—The "Journal" states that Battle & Newman have been awarded the government contract for taking down and rebuilding the piers at Port Dalhousie. The cost of the work will be between $60,000 and $70,000, and it will take two to three years to complete it.

GARBAGE CREMATORIES.—Little Rock, Ark.—The board of public affairs is reported to have been instructed to advertise for bids for a garbage crematory.

St. Paul, Minn.—The bids recently received for a garbage crematory have all been rejected and the committee will advertise for new bids.

PIER WORK.—New York, N. Y.—Bids are asked by the department of docks until Nov. 8 for repairing the approaches to piers, new 46 and new 47, North River, the work including the removing of 33,000 sq. ft. of deck and sheathing, etc., and the furnishing of 179,044 ft. of yellow pine timber, 9 oak fenders, 13,950 lbs. wrought iron spikes and nails, etc.; and will until Nov. 15 for repairing the pier and dumping board at the foot of West 19th St., North River.

CANAL IMPROVEMENTS.—Buffalo, N. Y.—Local papers state that the following bids were received for state work on the Oswego division of the Erie Canal: Donnelly Contracting Co., $23,208; Brayer & Albaugh, $23,424; John Hendricks, $25,373; Farwell, Bennett & Farwell, $29,329. For work on Braddock's dam the bids were as follows: The Donnelly Contracting Co., $15,463; Brayer & Albaugh, $15,999.

CANAL WORK.—Ottawa, Ont.—Bids are asked until Nov. 17 for constructing two sections of the Trent Canal; 5½ miles on the Simcoe and Balsam Lake division, and 3½ miles on the Peterboro and Lakefield division. The first section is reported as mostly rock cutting, the excavation in some parts being over 30 ft. The second section will have two locks. J. H. Balderson, Secy. Dept. Rys. and Canals.

TELEPHONE FRANCHISE.—Port Huron, Mich.—A franchise has been granted to the Harrison Telephone Co., of Grand Rapids. Chas. Taylor, representing the company, stated to the council that the company is now establishing plants in Grand Rapids, Kalamazoo and Toledo, and that the Port Huron plant would be completed by Jan. 1, and that a line would be built to Detroit in the spring.

LEVEE WORK.—Vicksburg, Miss.—Bids are asked until Nov. 5 for about 260,000 cu. yds. of work on Red River from Scopini to Ash Point, in Bossier parish, La. Capt. J. H. Willard, U. S. Engr. Office.

Memphis, Tenn.—Bids are asked until Nov. 16 for 198,000 cu. yds. of work in the Upper Tensas levee district and 297,000 cu. yds. in the Middle Tensas levee district. Capt. C. McD. Townsend, U. S. Engr. Office.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
Nov. 2.	Dredging.	Philadelphia, Pa.	Oct. 4
	Advertised, Eng. News, Oct. 4 to 25.		
Nov. 2.	Brick sidewalks.	Richmond, Ind.	Oct. 18
Nov. 3.	Sewers.	Sandusky, O.	Oct. 25
Nov. 5.	Dike work.	Philadelphia, Pa.	Oct. 11
	Advertised, Eng. News, Oct. 11 to Nov. 1.		
Nov. 5.	Asphalt paving.	Cincinnati, O.	Oct. 11
Nov. 5.	Brick paving.	Cincinnati, O.	Oct. 11
Nov. 5.	Dredging.	Philadelphia, Pa.	Oct. 18
Nov. 5.	Furnishing dredges.	New Orleans, La.	Oct. 18
Nov. 5.	Bridges, Meridian, Miss.		Oct. 18
Nov. 5.	Asphalt paving.	Cincinnati, O.	Oct. 18
Nov. 5.	100-ton shear legs, Phila. navy yard.		Oct. 25
Nov. 5.	Asphalt paving.	New York, N. Y.	Nov. 1
Nov. 5.	Pipe sewers.	Rochester, N. Y.	Nov. 1
Nov. 5.	Brick sewer.	Jersey City, N. J.	Nov. 1
Nov. 5.	Levee work.	Vicksburg, Miss.	Nov. 1
Nov. 5.	Water-works system.	Oswego, Ill.	Nov. 1
Nov. 5.	Sewer.	St. Paul, Minn.	Nov. 1
Nov. 5.	Elevators.	Minneapolis, Minn.	Nov. 1
Nov. 5.	Sidewalks.	Houston, Tex.	Nov. 1
Nov. 6.	Breakwater and piers.	Milwaukee, Wis.	Oct. 4
	Advertised, Eng. News, Oct. 4 to 25.		
Nov. 6.	Electric lighting.	Terre Haute, Ind.	Oct. 18
Nov. 6.	Bridge work.	Bath, Me.	Nov. 1
Nov. 6.	Buoys, etc.,	Tompkinsville, N. Y.	Nov. 1
Nov. 6.	Brick paving.	Muscatine, Ia.	Nov. 1
Nov. 6.	Water-works system.	Sioux City, Ia.	Nov. 1
	Advertised, Eng. News, Oct. 18.		
Nov. 6.	Grading, etc.,	Washington, D. C.	Nov. 1
Nov. 7.	Public building work at	York, Pa.	Oct. 11
	Advertised, Eng. News, Oct. 11 and 18.		
Nov. 7.	Water bonds.	Arlington Heights, O.	Oct. 11
Nov. 7.	Pipe sewers.	Ironton, O.	Oct. 18
Nov. 7.	Dredging.	Wilmington, N. C.	Oct. 11
	Advertised, Eng. News, Oct. 11 to Nov. 1.		
Nov. 7.	Pipe sewer.	Saratoga Springs, N. Y.	Oct. 25
Nov. 7.	Water bonds.	Long Prairie, Minn.	Oct. 25
Nov. 7.	Water supply, etc.,	Fort Reno, Okla.	Oct. 25
Nov. 7.	Sewer bonds ($25,000).	Melrose, Mass.	Nov. 1
Nov. 7.	Sewer.	Trenton, N. J.	Nov. 1
Nov. 7.	Sewers.	Columbus, O.	Nov. 1
Nov. 7.	Pipe sewers.	Ironton, O.	Nov. 1
Nov. 8.	Outlet sewer.	Cranford, N. J.	Oct. 18
	Advertised, Eng. News, Oct. 18 to Nov. 1.		
Nov. 8.	Granite paving.	Cincinnati, O.	Oct. 25
Nov. 8.	Brick paving.	Cincinnati, O.	Oct. 25
Nov. 8.	Water-works system.	Talmage, Neb.	Oct. 25
Nov. 8.	Rebuilding sewer.	Brooklyn, N. Y.	Nov. 1
Nov. 8.	Pier work.	New York, N. Y.	Nov. 1
Nov. 8.	Laying water mains (9 Sts.).	Chicago.	Nov. 1
Nov. 8.	Dredging, etc.,	Toronto, Ont.	Nov. 1
Nov. 9.	Dredging.	Wilmington, Del.	Oct. 11
	Advertised, Eng. News, Oct. 11 to Nov. 1.		
Nov. 9.	Furnishing dredge.	New Orleans, La.	Oct. 18
Nov. 9.	Grading, etc.,	Hamilton, O.	Oct. 18
Nov. 9.	Iron bridge,	New Orleans, La.	Oct. 25
Nov. 9.	Street improvements.	Avondale, O.	Oct. 25
Nov. 9.	Stand-pipe.	St. Charles, Mo.	Oct. 25
	Advertised, Eng. News, Oct. 25 and Nov. 1.		
Nov. 9.	Laying water pipe.	Rochester, N. Y.	Nov. 1
	Advertised, Eng. News, Nov. 1.		
Nov. 9.	Sewers.	St. Louis, Mo.	Nov. 1
Nov. 10.	Granite blocks (100,000).	Bangor, Me.	Oct. 25
Nov. 10.	Naval supplies.	Washington, D. C.	Oct. 25
Nov. 10.	Water-works system.	Rossville, Ill.	Oct. 25
Nov. 10.	Pier work.	Duluth, Minn.	Oct. 25

Nov. 10. Supplies at New York navy yard.....Nov. 1
Nov. 10. Supplies at Norfolk navy yard.....Nov. 1
Nov. 10. Road building, Missoula, Mont.....Nov. 1
Nov. 10. Macadamizing, Tiffin, O.....Nov. 1
Nov. 10. Pipe sewers, Fort Dodge, Ia.....Nov. 1
Nov. 11. Pumping engines, Chicago, Ill.....Oct. 18
Advertised, Eng. News, Sept. 13 to 27.
Nov. 12. Pipe sewer, Huntington, Ind.....Oct. 25
Nov. 12. Artesian wells, Wichita, Kan.....Oct. 25
Nov. 12. Dredging, San Francisco, Cal.....Oct. 25
Nov. 12. Air pump and jet condenser, Cleveland. Nov. 1
Nov. 12. Pipe sewers, South Bend, Ind.....Nov. 1
Nov. 12. Sidewalks, Houston, Tex.....Nov. 1
Nov. 13. Heatg & vent'g ap.,etc.,Sioux Falls, S.D. Oct. 18
Advertised, Eng. News, Oct. 18 and 25.
Nov. 14. Dredging, Charleston, S. C.....Oct. 18
Advertised, Eng. News, Oct. 18 to Nov. 8.
Nov. 14. Revetting banks, Charleston, S. C.....Oct. 18
Advertised, Eng. News, Oct. 18 to Nov. 8.
Nov. 15. Decked barges, New Orleans, La.....Oct. 25
Nov. 15. Water-works system, Union City, O.....Oct. 25
Nov. 15. Pier work, New York, N. Y.....Nov. 1
Nov. 15. Sewer pipe, Arlington Heights, O.....Nov. 1
Nov. 15. Water tower and tank, Hull, Ia.....Nov. 1
Nov. 16. Levee work (495,000 cu.yds), Memphis..Nov. 1
Nov. 17. Canal work, Ottawa, Ont.....Nov. 1
Nov. 19. Stone, Philadelphia, Pa.....Oct. 25
Advertised, Eng. News, Oct. 25 to Nov. 15.
Nov. 19. Water extensions, Johnstown, N. Y.....Nov. 1
Nov. 20. Dredging, Philadelphia, Pa.....Nov. 1
Nov. 20. Asphalt paving, Terre Haute, Ind.....Nov. 1
Nov. 21. Paving, Dayton, O.....Nov. 1
Nov. 22. Electric light plant, Dayton, O.....Oct. 25
Nov. 23. Pipe sewers (10,000 ft.), Warren, O.....Nov. 1
Nov. 23. River improvement, Ottawa, Ontario..Nov. 1
Nov. 24. Elec. r'y sale, N. Westminster, B.C...Nov. 1
Nov. 26. Water supply, Monroe, Mich.....Nov. 1
Nov. 26. Bridge, Houston, Tex.....Nov. 1
Nov. 27. Public Building at Camden, Ark.....Nov. 1
Advertised, Eng. News, Nov. 1 and 8.
Dec. 1. Electric lighting, Ann Arbor, Mich.....Oct. 11
Dec. 10. Buildings, etc., at Mare Island, Cal.....Nov. 1
Dec. 20. Water bonds, New Paynesville, Minn..Nov. 1
No date. Interior bldg. const'n, Buffalo, N.Y.....Nov. 1
" " .Sewer pipe, Akron, O.....Nov. 1

CONTRACT PRICES.

STONE.—St. Augustine, Fla.—The following bids were received by Maj. Thos. H. Handbury, U. S. Engr. Office, Oct. 25, for furnishing 10,000 tons of rock in place on the jetty at the northeast entrance to the harbor of Key West, Fla., the price being per ton of 2,000 lbs.:

Neeld & Weiskopf, Washington, D. C.	Gneiss	$5.68
Thos. Woodroffe, Greensboro, N. C.	Granite	6.90
R. G. Ross, Jacksonville, Fla.	Granite	3.80
S. S. Leonard & Co., Pensacola, Fla.	Granite	5.10
I. H. Hathaway & Co., Philadelphia, Pa.	Granite	4.95
Edward H. Gaynor, Savannah, Ga.	Not stated	6.40

BREAKWATERS.—New York, N. Y.—The following bids were received by Lieut.-Col. Henry M. Robert, U. S. Engineer Office, Oct. 16, for constructing breakwaters, the prices being per cubic yard:

Bidder.	Duck Island, Conn.	New Haven, Conn.	Mouth Housatonic River, Conn.	Glen Cove Harbor, N. Y.
C. F. Stoll, New London, Conn.	$1.23	....	....	$1.40
Brown & Fleming, 129 Broad St., N. Y.	.97	$1.06	$1.14	.73
J. J. Moran, 5 Court Sq. Bklyn.	....	.95	....	....
S. & E. S. Belden, Hartford, Conn.	.95	.96¾	1.09*	..
J. A. Bouker 110 Wall St., N.Y.	1.23	1.05	1.10	.65*
		1.13		
HughesBros.& Rangs, Syracuse	.68*	.74*	....	....
A. M. Newton, New York	....	1.06	....	....

* Recommended for acceptance.

MACADAMIZING AND GRADING.—Argentine, Kan.—Geo. M. Walker, Jr., Cy. Engr., writes us that the following bids have been recently received for macadamizing, the price per square yard including the macadamizing proper, subgrading, stone cross-walks, resetting curbing and all necessary work to change the streets from their present condition into finished streets: (1) being First St. (telford base), (2) Metropolitan Ave., (3) Silver Ave., (4) Fifth St. and (5) Strong Ave.:

	1.	2.	3.	4.	5.
H. Boeke	$1.16	$1.14	$1.11	$1.09	$.90
A. J. Armstrong.	.96	1.02	*1.02	1.02	.92
T. J. Payne	1.27½	1.34¼	1.53½	1.33⅜	1.42¾
R. B. Brown	1.40	1.45	....	....	1.55
T. J. Enright	*.949	*1.01½	1.129	*.99¼	*.89¾

* Contracts awarded.

The contract for grading Ruby Ave. was awarded to T. J. Payne at 18¾ cts. for earth excavation, 44½ cts. for loose rock, 59 cts. for solid rock and $25 per M. ft. for oak lumber for drains.

SEWERS.—Mattoon, Ill.—M. B. Fitch, Cy. Engr., writes us that the contract for constructing sewers in district No. 6 has been awarded to William Davidson. The bids were opened Oct. 16, and were as follows:

Bids for Constructing Sewers in District No. 6, Mattoon, Ill.

	Main sewer—					Branches—						
	36-in. [1]brick, 1571ft.	30-in. [1]brick 879ft.	24-in. 724ft.	21-in.[2] 325ft.	18-in. 775ft.	Pipe. 12-in. 370ft.	15-in. 650ft.	18-in. 650ft.	18-in. 650ft.	Manholes, 11.	Lampholes, 4.	Total.
Thos. S. Davy, Lincoln, Ill.	$2.40	$1.75	$1.20	$0.95	$0.70	$0.45	$0.65	$0.70	$1.00	$15.00	$4.00	$8,917
W. R. Mercer, Indianapolis.	2.00	1.90	1.10	.90	.75	.50	.70	.80	1.10	30.00	7.00	8,752
Mockler& Fullerton,St.Louis.	1.70	1.60	1.20	1.00	.80	.30	.60	1.00	1.00	30.00	5.00	8,063
Jas. H. Roche, Chicago, Ill.	2.05	1.87	1.23	1.05	.77	.34	.87	1.02	1.25	18.50	2.50	9,001
DubuqueConst'n Co.,Dubuque	1.90	1.70	1.37	1.08	.83	.38	.60	.93	1.05	30.00	10.00	8,675
Hallert & Anderson, Aurora.	1.90	1.85	1.30	1.20	1.10	.45	.75	1.20	1.35	25.00	5.00	9,411
William Davidson,Mattoon,Ill	1.75	1.75	1.15	.85	.70	.30	.55	.65	1.00	23.00	5.00	7,778

[1] Single ring brick. [2] Or 22-in.

Philadelphia, Pa.—The following contracts for constructing sewers were awarded by Jas. H. Windrim, Dir. Pub. Wks., Oct. 22, to D. McMahon, Germantown, Philadelphia: Main sewers in Terrace, Sharp, Hermit, Seville and East streets, 24-in., 840 ft., at $3.40 per lin. ft.; 15-in. pipe, 1,508 ft., at $2.84; 12-in. pipe, 1,015 ft., at $2.84; connections with intercepting sewer, Manayunk, on Martin and Pechin streets, 27-in., 772 ft., $3.65; 24-in. 252 ft., $3.20; 15-in. pipe, 873 ft., $3.40; contracts were also awarded for 18 branch sewers, in different portions of the city, aggregating $51,000.

Watertown, Wis.—G. O. Viebahn, Cy. Engr., writes us that the following bids were received Oct. 20 for constructing sewers:

Bids Received Oct. 20, 1894, for Constructing Sewers, at Watertown, Wis.

Bidder.	8-in., 15,381 ft.	10-in., 4,553 ft.	12-in., 2,757 ft.	15-in., 1,435 ft.	18-in. 545 ft.	20-in., 780 ft.	Manholes. 53.	Flush tanks, 18.	Total.
William Murphy	$0.25	$0.35	$0.54	$0.50	$1.50	$1.68	$16.00	$37.00	$11,401.78
R. J. Wilson	.34	.48	.50	.68	.75	.83	26.00	28.00	12,707.45
Geo. R. King & Co.	.37	.445	.485	.85	.99	1.30	33.25	34.50	14,210.75
Hick & Cogan	.40	.40	.55	.60	1.65	1.75	18.00	52.00	14,595.20
J. D. Moran Co.	.39	.49	.56	.74	.98	1.12	34.50	38.00	14,755.58
Green & Peterson	.41	.55	.60	.75	.90	1.35	30.00	32.00	15,251.31
Dillon & Kelly	.43	.49	.59	.80	1.00	1.00	20.00	95.00	15,714.43
Kirkland & Starkey	.455	.56	.62	.86	1.07	1.38	30.00	30.00	16,281.06
McCann & McSeilan	.43	.52	.60	.93	1.40	1.82	30.00	35.00	16,352.74
Anderson & Lindquist	.45	.55	.60	.90	1.25	1.75	30.00	34.00	16,619.55
Jas. Healy & Son	.45	.69	.70	1.03	1.13	1.33	21.50	24.50	16,645.23
F. L. Reeves & Magnus	.50	.55	.70	.75	1.10	2.25	27.00	30.00	17,526.30
James Markey	.53	.58	.65	.73	.98	1.62	32.00	43.00	17,899.97
William Gorder	.60	.65	.67	.76	.90	1.00	30.00	25.00	18,436.34
N. F. Reichert & Co.	.56	.70	.80	.95	1.25	1.85	28.00	30.00	19,517.56
James H. Fife	.55	.79	.65	1.00	1.25	1.58	32.00	37.00	19,550.12
Nic. Forrestal	.60	.90	1.00	.90	1.60	1.90	16.00	1.00	20,594.80
C. A. Mosher	.69	.63	.71	.74	.875	1.03	36.00	53.00	20,643.92
Burke & Dwyer	.63	.73	.73	.81	1.15	1.50	38.00	38.00	20,684.16
R. H. Radtke	.60	.70	.75	.95	1.50	1.75	30.00	95.00	21,329.20
J. Werner	.67	.75	.90	1.05	1.60	2.00	35.00	40.00	22,715.07

Auburn, N. Y.—The following bids were received for a sewer in Wall St., the contract being awarded to Peter Byrne:

	Dennis McCarthy.	Peter Byrne.	Jeremiah Corkery.	Byrne & McCorm'k
18-in. tile, per rod	$14.00	$14.00	$13.95	$13.80
15-in. " " " "	12.50	10.50	12.00	11.86
12-in. " " " "	9.75	8.00	9.45	9.50
10-in. " " " "	9.00	7.00	8.00	8.50
8-in. " " " "	7.75	6.50	7.45	7.00
5-in. " " " "	4.50	3.25	3.50	4.25
Conduits	35.00	30.00	35.00	35.00
Manholes	35.00	28.00	25.00	28.00
Rock excavation	3.50	2.50	2.50	3.00

Fort Madison, Ia.—The following bids were received for constructing a sewer in three streets, according to the "Democrat":

	Peter Simons.	Schulte & Putker.	T. H. Moore & M.L.Lane.
24-in. pipe, per lin. ft.	$0.84	$0.75	$0.30
18-in. " " " "	.74	.68	.27
12-in. " " " "	.42	.38	.10
10-in. " " " "	.42	.38	.10
Manholes, each	35.00	35.00	17.50

ASPHALT AND STONE PAVING.—Omaha, Neb.—The "Bee" states that the lowest bid ever received in this city for asphalt paving previous to Oct. 19 was at $2.41 per sq. yd. and that the prices last year ranged from $2.52½ to $2.60 per sq. yd. On Oct. 19 bids were opened for about 38,000 sq. yds of asphalt paving in Sherman Ave. and Hugh Murphy bid as follows: 2 ins. of asphalt and 5 ins. of concrete, $2.15 per sq. yd.; 2 ins. asphalt and 5 ins. asphaltic binder, $2.19; 2½ ins. asphalt and 4½ ins. concrete, $2.07; 2½ ins. asphalt and 4½ ins. asphaltic binder, $2.19; all with a 5-year guarantee. The next lowest bid was at $2.43, $3.15, $2.45 and $3.30, respectively. Mr. Murphy has been getting a large proportion of the stone paving contracts in the city for several years, but has never before bid on asphalt work.——The lowest bid for paving Jackson St., between 36th and 38th Sts., with asphalt was that of the Standard Paving Co., at $2.57 per sq. yd.——The lowest bid for paving Tenth St., from Mason to William Sts., with Colorado sandstone was that of Hugh Murphy, at $1.59 per sq yd.

MACADAMIZING.—Boston, Mass.—The following bids were received Oct. 27 for building a telford macadam road in St. Germain St., from Massachusetts Ave. to Dalton St.:

	P. F. Lonergan & Co.	F. J. Hughes.	Quimby & Ferguson.	H. Gore & Co.
Subgrading, 200 cu. yds.	$0.49	$0.35	$0.30	$0.60
*Telford base, 1,600 sq.yds.	.27	.125	.11	.28
*Macadam, 1,600 sq. yds.	.24	.125	.20	.25
**Granite block gutters.	2.26	2.10	2.00	2.40
Edgestones, 1,250 lin. ft.	.33	.30	.20	.30
Brick sidewalks,1,030sq.yds	1.12	.95	1.00	1.10
Flag'g cross wlks,40 sq.yds	4.95	4.75	4.00	4.50
Gravel, 2,000 cu. yds.	1.09	.95	.95	1.15

* Stone furnished by the city. ** 510 sq. yds.

GRADING, ETC.—New Castle, Pa.—The contract for grading and macadamizing State St. has been awarded to Ed. McWilliams, at $4.80 per carload delivered on the street, the other bidders being P. J. Scanlon, $5.60; Amos Satcher, $6.60; John Walters, $9; Morris Johnson, 48 cts. per cu. yd.; W. H. Mitchell, 48 cts. per cu. yd.

ASPHALT PAVING.—Binghamton, N. Y.—The contract for paving Commercial St., from Court St. to the present brick pavement, has been awarded to the Warren-Scharf Asphalt Paving Co., at $2.75 per sq. yd.

Rahway, N. J.—The contract for paving Cherry St. with Asphalt has been awarded to the Barber Asphalt Paving Co., at $2 per sq. yd. This was the only bid received.

REMOVING LEDGE—Boston, Mass.—The following bids were received by Col. S. M. Mansfield, U. S Engineer Office, for the removal of 8,772 cu. yds. of ledge from Boston Harbor:

Geo. Willett Andrews, Biddeford, Me.	per cu.yd. $16.62
Townsend & Johnston, Somers' Point, N.J.	" 16.48
P. Sanford Ross, Jersey City, N. J.	" 18.00

LEVEE WORK.—Memphis, Tenn.—The following bids were received by Lieut. J. C. Sanford, U. S. Engineer Office, Oct. 9, for the construction of levees in the Upper Yazoo levee district, (1) being the price per cubic yard for sections 1 to 4, (2) sections 5 to 7, (3) sections 8 to 10, (4) sections 18 to 22, (5) Union Lake:

Bids Received at Memphis, Tenn., for Constructing Levees.

	1. cts.	2. cts.	3. cts.	4. cts.	5. cts.
Chas. H. Dameron, Friar's Point, Miss.	....	....	....	....	9.99
Timothy Sullivan, Memphis, Tenn.	10.95	10.95	11.2	11.2	12.98
McLaughlin Bros., Memphis, Tenn.	10.75	12.	11.5	12.75	14.75
L. C. Dulaney, Mayersville, Miss.	11.75	16.	13.99	12.44	....
Hugh McCartin, Memphis.	....	....	....	....	13.5
W. A. Shipley, Friar's Point, Miss.	14.	14.75	....	11.	8.99
Batt O'Brien, Memphis.	13.45	14.25	13.98	15.24	11.23
Manning & Gibson, Oakwood, Miss.	14.	....	15.	9.985	12.74
T. S. Aderholdt, Friar's Point, Miss.	14.40	16.20	11.74	12.74	10.24
Moore & Walsh, Memphis.	10.625	15.75	12.375	9.98	....
Martin Jennings, Memphis.	....	....	....	....	11.375
J. C. McIntyre & Co., Memphis.	11.375	14.4	12.25	11.48	14.
Robert Johnson, Memphis.	11.74	15.24	14.49	14.24	16.99
John G. Sessions, Leota, Miss.	10.	12.05	9.95	11.05	12.97
James K. Jeffries, Memphis.	13.	13.	12.5	14.	....

BRICK PAVING.—Kansas City, Kan.—The contract for paving James St. with brick has been awarded to C. W. Benning, at $1.04 per sq. yd., the other bids being R. J. Boyd, $1.20; H. S. Trestrail, $1.19; Gray & Farris, $1.15; J. B. Smith & Co., $1.13.

Cincinnati, O.—The following bids were received last week for paving two alleys with brick: W. T. Marshall, $1.30 and $1.25 per sq. yd., respectively; Evan Evans, $1.07 and $1.07; John C. McDermott, $1.25 and $1.25; J. M. Quill, $1.10 and $1.10; James Agnes, $1.05 and 95 cts.; Thomas Evans, $1.05 and $1.05; M. T. Flynn, $1 and $1.25; Henry Diekmeier, $1 and $1.05. Bids on grading were either 10 cts. or 1 ct. per cu. yd., offsetting prices on materials.

ELECTRIC LIGHTING.—Rome, N. Y.—The contract for furnishing 150 arc lights of 2,000 c. p. for one year has been awarded to the Rome Gaslight Co., at $94.90 per light, each light to burn every night and all night.

MACADAMIZING.—South Amboy, N. J.—Asbury Fountain, Chn. Bd. Freeholders, writes us that contracts for constructing roads were awarded last week as follows: B. M. & J. F. Shanley, telford road 12 ft. wide in Woodbridge township and Perth Amboy, a distance of about five miles, at $1.04 per lin ft.; H. S. Wilson, Dunnellen, macadam road 12 ft. wide in Raritan township, from Oak Tree to Holly's Corner, 1½ miles, at 96 cts. per lin. ft.

PIPE.—Chicago, Ill.—Dennis Long & Co. are reported to have been awarded a contract for 2,000 tons of 12 to 6-in. cast iron pipe, at $17.90 per ton.

Barre, Mass.—Press reports state that the Barre Water Co. has contracted with the Warren Foundry & Machine Co., for 350 tons of 12 to 8-in. pipe, at $24 per gross ton.

METAL MARKET PRICES.

LEAD.—New York; 3.05 to 3.10 cts. Chicago: 2.9 to 2.95 cts. St. Louis: 2.9 to 2.92 cts.

NAILS.—Pittsburg: 90 cts. to $1 for wire, and 85 cts. for cut at mill, in carload lots.

BARBED WIRE.—Pittsburg: galvanized, $1.9 plain, $1.15 to $1.2 for carload lots at mill.

FOUNDRY AND PIG IRON.—New York: $10.50 to $13. Pittsburg: $10.75 to $11.75. Chicago: $9.50 to $11.50.

TRACK MATERIAL.—New York: angle bars, 1.25 to 1.4 cts.; spikes, 1.55 to 1.7 cts.; track bolts, 2 to 2.1 cts. with square, and 2.15 to 2.3 cts. with hexagon nuts. Chicago: angle bars, 1.25 to 1.35 cts.; spikes, 1.65 to 1.75 cts.; track bolts, 2.1 to 2.2 cts., with hexagon nuts.

RAILS.—New York: $24 at eastern mills and at tidewater; old rails, $10.50 to $11.50 for iron and $8 to $8.50 for steel; steel rails, fit for relaying, $16 to $19; light rails, $22 to $24; girder rails, $24. Pittsburg: $24 for standard sections. Chicago: $25 to $27; old rails, $11 for iron and $7.50 to $11 for steel.

STRUCTURAL MATERIAL.—New York: beams, 1.3 to 1.5 cts.; channels, 1.35 to 1.5 cts.; angles, 1.25 to 1.35 cts.; tees, 1.4 to 1.6 cts.; universal mill plates, 1.25 to 1.35 cts.; steel plates, 1.25 to 1.4 cts. for tank, 1.4 to 1.5 cts. for shell, 1.6 to 1.65 cts. for flange, 1.75 to 2 cts. for ordinary firebox, 2 to 2.25 cts. for locomotive firebox. Pittsburg: beams, 1.25 to 1.35 cts.; channels, 1.25 to 1.35 cts., angles, 1.15 to 1.2 cts.; tees, 1.35 cts.; universal mill plates, 1.15 to 1.2 cts.; steel plates, 1.15 to 1.25 cts. for tank, 1.25 to 1.35 cts. for shell, 1.3 to 1.4 cts. for flange, 2.5 to 3.75 for ordinary firebox, and 3.35 to 3.5 cts. for locomotive firebox. Chicago: beams, 1.5 cts.; channels, 1.5 cts.; angles, 1.4 to 1.45 cts.; tees, 1.65 cts.; universal plates, 1.4 to 1.45 cts.; steel plates, 1.4 to 1.5 cts. for tank, 1.65 to 2.1 cts. for flange, 1.65 to 5 cts. for firebox.

INDUSTRIAL NOTES.

THE NEW YORK ASBESTOS MFG. CO., New York city, is introducing a new air-space covering for boilers and steam pipes.

THE KENNEDY VALVE CO., of New York city, dealing in all styles of valves, cocks, hydrants, etc., has removed from 52 Cliff St. to new and more roomy quarters at 75 John St.

H. E. COLLINS & CO., of Pittsburg, Pa., have sold 2,000 HP. of the Cahill water-tube boilers for the pumping station now being erected for the Carnegie Natural Gas Co., at Bagdad, Pa.

THE BUFFALO TOOL & STAMPING CO., Buffalo, N. Y., is about to build a $10,000 addition to its plant on Spring St., near William St. August Esenwein, architect, is preparing the plans.

LOCOMOTIVE.—The Appalachian Steel & Iron Co., Big Stone Gap, Va., wants a second-hand saddle-tank locomotive of 36 ins. gage, weighing about ten tons and able to operate upon curves of 40 ft. radius.

THE AMERICAN RAILWAY MAINTENANCE SYNDICATE, of New York city, is introducing the Webber hand brake for street cars and the Stewart railway switch, both of which we shall illustrate and describe shortly.

THE STANDARD ASPHALT PAVING CO., of Bridgeport, Conn., has completed its plant for its local contracts for paving on Main and State Sts., and will begin work as soon as the concrete foundations are completed.

IRON WORKS.—Casper Tipfer is building on Letchworth St. and the canal and railway, Black Rock, near Buffalo, N. Y., a plant for the manufacture of iron beams for buildings and bridge work. The main building will be 80 × 250 ft.

CEMENT WORKS.—New cement works are to be built near Phillipsburg, N. J. The projectors are Elkins, Erett & Garechi, a Philadelphia company, and will be capitalized for $300,000. Work will be commenced shortly, according to press despatches.

THE PIERPOINT BOILER CO., of Pittsburg, Pa., has received a contract for an order for 500 HP. of Pierpoint water-tube boilers from the Philadelphia Natural Gas Co., at Murraysville, Pa.; and also for a battery of boilers for the Laurel Grove plantation, at La Fourche, La.

THE KANSAS CITY CAR & FOUNDRY CO., Kansas City, Mo., has its new shops nearly completed. They cover 14 acres of ground, and consist of a blacksmith and machine shop, 50 × 112 ft.; erecting shop, 250 × 175 ft.; wood-working shop, 75 × 112 ft.; engine room, 32 × 60 ft., and a kiln to dry the lumber in.

THE ROANOKE RAPID POWER CO., of Baltimore, Md., with a paid-up capital of $2,000,000, has purchased 3,000 acres of cotton-growing land at Roanoke Rapids, N. C., and has begun the erection of a 24-set knitting factory and a 20,000-spindle cotton mill, which will give employment to 1,000 persons. Pres., Wm. A. Habilston, of Petersburg; Vice-Pres., W. G. Maxwell, of New York.

THE PENN BRIDGE CO., of Beaver Falls, Pa., reports that work has been commenced on the bridge at Glenwood, Pa., across the Monongahela River. It will have a center span of 520 ft., two spans of 300 ft. each, with viaduct approach at each end, and is to carry street railway and highway traffic. The contractor is Samuel P. White, and the superstructure is being built by the Penn Bridge Co., of Beaver Falls, Pa., and the substructure by Jutte & Foley, of Pittsburg.

THE YOUNGSTOWN BRIDGE CO., of Youngstown, O., has the contract for eight spans of girders for the Cleveland, Lorain & Wheeling R. R., and the contract for buildings for the Beaver Tin Plate Co., of New Lisbon, O., consisting of the mill building, 100 × 200 ft., annealing house, and boiler house. It has also been awarded the contract for the Junction Ave. bridge for the Lake Shore & Michigan Southern Ry., at Toledo, O.; the Bayou Natchez bridge at Natchitoches, La., and a building for the Jeanette Bottle Works, at Jeanette, Pa.

THE HAMILTON BRIDGE CO., of Hamilton, Ont., has made an assignment to C. S. Scott, official assignee, according to statements in the Montreal papers. The immediate cause of the assignment was a judgment for $10,000 obtained by A. T. Wood, one of the directors, against the company. The firm is said to be quite responsible financially, but there has been friction among the directors, principally due to Mr. Wood's desire to withdraw from the company. The capital stock of the company is $100,000, of which $60,000 is paid up. William Hendrie is the principal shareholder.

MACHINE TOOLS.—When the government has officially notified the successful bidders for over $100,000 of machine tools, and machinery for the Washington navy yard, it will give considerable work to a number of the big machine shops. The contracts will be awarded to the lowest bidders, as is customary, and these are from different sections of the country. The Niles Tool Works and Morgan Engineering Co., of Ohio, will be awarded $25,000 of machine tools and cranes. Manning, Maxwell & Moore, of New York, representing the Pond Machine Co., get a good contract in boring mills. The Ellicott Machine Co., of Baltimore, was the successful bidder on an automatic engine and power-transmitting machinery. The Betts Machine Tool Co., of Wilmington, Del., will get a large contract for heavy machine tools, and Bement, Miles & Co., of Philadelphia, are the lowest bidders on the greatest amount of machine tools. This equipment for the Washington navy yard is the largest order that has been in the machine tool and machinery market for many months.

NEW COMPANIES.—Hiawatha Co-Operative Car & Mfg. Co., Hiawatha, Kan.; $50,000; W. F. Heslop, Charles K. Nabb and C. O. Allen.——Carter Brake Co., Chicago, Ill.; $2,000,000; Samuel C. Carter and R. E. Lindgerwood.——Banning Co., Los Angeles, Cal.; water-works, etc.; $1,000,000, commencing with $100; Wm. Banning and J. B. Banning.——South Pacific Phosphate Co., San Diego, Cal.; $100,000, commencing with $10,000; A. H. Isham and A. M. Crittenden.——Excelsior Springs Gas, Light & Fuel Co., Excelsior Springs, Mo.; $20,000; R. C. Massie, E. L. Dimmit and F. A. Tucker.——Equipment Construction Co., Batavia, N. Y.; $10,000; railway and electrical supplies; M. H. Johnson, T. P. Nightingale and L. Beecher.——Uinta Tunnel Co., Chicago, Ill.; mining tunnel through Battle Mountain, El Paso county, Colo.; $1,200,000; Percy B. Coffin, Henry B. Barbour, and Chas. F. Marfarlane.

MUNICIPAL BOND MARKET.

New York, Oct. 30, 1894.

It is not an easy task to describe the current conditions in the municipal bond market. It is possible to reiterate the statements made a week ago as to the great demand, and the greater scarcity, except that these factors have become even more intensified. Illustrative of the eagerness of dealers to replenish their much-reduced stocks, one can quote the recent sale of Passaic, N. J., bonds. The issue was for $120,000, for court house purposes, bearing 4½ per cent. interest, and averaging 44½ years. Each bidder had to deposit $6,000 in advance, but, notwithstanding the small amount of the issue, there were 17 bids made, and the successful buyers, Blair & Co., had to pay 109.59 for their purchase. The evident determination of so many bond houses to secure the issues, that forced the bids up to this high figure, shows the anxiety of dealers to pick up any and every bond issue that offers the least attraction as to security. The return on the investment, so long as it is around 3½ or 4 per cent., is hardly considered in the purchase.

The high price realized at the Passaic sale is in accordance with the current figures for municipal bonds quoted last week. This table of quotations is the best illustration possible of how dear good investments have become by reason of the great plenty of money. And it is not likely, at this writing, that money will become any scarcer in the next few months. Already the crop movement has begun in good earnest and money still rules at the various financial centers at extremely low rates. Call loans continue to be made here on a ½ of 1 to a 1 per cent. basis, while out West rates are around 2 per cent., but borrowers are scarce. There is no immediate likelihood that surplus funds in the banks will be much reduced; the contrary seems more probable. Such being the case, the demand for investment securities, with capital indisposed to seek industrial or commercial enterprises for employment, must increase to the inuring benefit of prices. This applies in all respects to the municipal bond market. There is an easy sale for all good issues and prices are more liable to rise than to ease off.

As furnishing to contracting engineers and other interested parties some index as to the credit enjoyed by municipalities and townships, the following table of current offerings is appended:

MUNICIPAL BONDS.

	Price.
City of Rochester, N. Y., Water 7s	127
City of St. Louis, Mo., Refunding, 6s	121½
City of Milwaukee, Wis., 5s	118½
State of California, Dock 4s	110
City of Menominee, Mich., School 6s	113
City of Birmingham, Ala., Impvt. 6s	108
City of Lawrence, Mass., Funding 4s	108½
Asbury Park, N. J., Water 5s	108
City of Mt. Vernon, N. Y., Ass. 5s	108
" " " " " School 4s	105¾
New Utrecht, N. Y. (Brooklyn), Impvt. 5s	113½
State of Idaho, Wagon Road 5s	108½
City of Manchester, N. H., 4s	106½
City of Lawrence, Mass., 4s	108½
City of Omaha, Neb., 5s	111

RAILWAY STOCK MARKET.

New York, Oct. 30, 1894.

Gloom still pervades the Stock Exchange district. Bear dominancy still obtains, and the whole railway stock list as a result of operations for the week ending to-day shows material declines. So thoroughly has Wall Street become imbued with the idea that prices are going to work lower and lower, that the operators on the bear tack have things pretty much to themselves.

The "Coalers," as the stocks of the anthracite-producing and carrying railway companies are generically known, have been way and above all the rest the features of the market. When Jersey Central loses 7⅜ per cent. on one day on sales of but 21,000 shares and Delaware & Hudson slumps 4½ points on transactions amounting to but 10,000 shares, there is every reason to believe that some phase of the coal trade situation reveals something wrong. Liquidation more than short sales was the cause of the recent comparatively large offerings of the coal stocks. Inside interests themselves seem to believe that the present situation and prospects in the coal trade warrant anything but hopes of prosperity and are parting with their holdings, feeling confident that they see an opportunity, if they market stocks now, to recover their holdings at a material decline. And, what with indiscriminate and unrestricted production and the consequent slashing to pieces of selling schedules, the fears as to material money losses seem well grounded.

On the other hand, the managers of the anthracite companies and their Wall Street representatives assert that the Stock Exchange diagnosis of the situation is all wrong. They declare that all the bad features of the coal trade have by this time been eliminated from the situation; that Wall Street should logically have sold the "Coalers" short some weeks ago, but that the improved prospects since then, by reason of a bettered demand from consumers and the low stocks in the hands of distributing agents must result within the next few weeks in a far more encouraging feeling in the trade. But Wall Street does not believe this.

That Reading and Lackawanna do not follow their fellow stocks is surprising to many people, but it can be easily explained. Lackawanna is a pure investment stock and the floating supply is far too little to warrant any decided speculative movement on the down grade. Most Reading stock is also tied up in the hands of people who are interested in the various schemes for the road's rehabilitation. Moreover, as one friend of the company puts it, the managers of the property now have an opportunity with the unrestricted production of coal to push forward the company's proper claim to mine more coal than has hitherto been allotted it at the monthly meetings of the general sales agents.

For the moment the Granger shares have evolved from comparative obscurity, by the showing of the Chicago, Burlington & Quincy, which reports for September and the nine months ending Sept. 30 respective net decreases of $348,747 and $729,791, thus showing that for the nine months only 1.87 per cent., as against 2.47 per cent. in 1893, was earned on the stock. Moreover, the result of the nine months' operations, counting on continued dividend payments, has been to more than wipe out the surplus left over from 1893 after paying 5 per cent. dividends. Northwest, too, comes in for some attention by reason of the approaching dividend period, but Wall Street may set all fears on this score aside, as the regular 3½ per cent. on the preferred and 3 per cent. on the common will surely be declared, the dividends having been more than earned.

Some consolation may be derived by discouraged holders of railway stocks from the cheerful prognostications of President Roberts, of the Pennsylvania Railroad Co.; he says: "Considerable improvement in the general situation is discernible and I am inclined to believe that business will gradually pick up and return to its normal state in the early part of 1895." There is to be a meeting on Friday of this week of the presidents of the trunk lines, when an effort is to be made to cause an appreciable improvement in the general railway situation. This should exercise a good influence on speculation and will serve to counteract some of the existing unhappiness as to the future.

RAILWAY STOCK MARKET.

Railway stocks.	Closing prices Oct. 30.
Alton & Terre Haute	31
Atchison, Topeka & Santa Fe	8½
Baltimore & Ohio	68
Canada Southern	50
Chesapeake & Ohio	18⅜
Chicago, Burlington & Quincy	72½
Chicago & Northwestern	101
Chicago, Milwaukee & St. Paul	60⅝
Chicago, Rock Island & Pacific	60¾
Cleveland, Cincinnati, Chicago & St. Louis	36⅛
Delaware, Lackawanna & Western	156⅝
Delaware & Hudson	121½
Hocking Valley	17½
Illinois Central	89¾
Lake Shore & Michigan Southern	132½
Louisville & Nashville	52⅞
Missouri Pacific	27¾
Missouri, Kansas & Texas	13¾
Mobile & Ohio	17
New Jersey Central	93
New York Central	98
New York & New England, all s. p.	30½
New York, New Haven & Hartford	187
New York, Chicago & St. Louis, 1st pfd	65
New York, Lake Erie & Western	16
New York, Ontario & Western	15½
New York, Susquehanna & Western	14
Northern Pacific	4½
Northern Pacific, pfd	16¼
Philadelphia & Reading	17
Richmond Terminal	17
St. Paul & Omaha	33
Southern Pacific	18
Texas Pacific	9¾
Union Pacific	11
Wabash, pfd	13⅞
Wheeling & Lake Erie	10¾

BOSTON RAILWAY STOCKS.

	Oct. 30.
Boston & Albany	204½
Boston & Maine	149
Fitchburg, pfd	77
Old Colony	177

PHILADELPHIA RAILWAY STOCKS.

	Oct. 30.
Lehigh Valley	34½
Pennsylvania Railroad	51¾